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# KEY

## TO

## GRADUATED EXERCISES

### IN
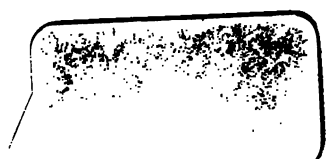
# ARITHMETIC AND MENSURATION.

# KEY

TO

## GRADUATED EXERCISES

IN

# ARITHMETIC AND MENSURATION.

———◆◆———

## EXERCISE I.

(1)... 
```
  20020020
     19037
    207500
   7000309
     10001
  27256867
```

(2)...
hf. cr. $19 \times 30 \times 4 = 2280$
fl. $17 \times 24 \times 4 = 1632$
$\overline{3912}$ far.

(3)...
```
   t.  cwt. qrs. lb.  oz.
   17   13   2   11   13
   20
  353
    4
 1414
   28
11323
 2828
39603
   16
237631
39603
633661 ounces
```

(4)...
```
  lb.  oz.  dwt.
   7   11   17
              12
             95
             20
           1917
             24
           7668
           3834
          46008 grains
```

(5)...
```
  E. ells  qrs.
   17       3
    5
   88
    4
  352 nails
```

B

|  | mi. | fur. | yds. |
|---|---|---|---|
| (6)... | 13 | 7 | 173 |

$$\begin{array}{r} 8 \\ \hline 111 \\ 220 \\ \hline 2393 \\ 222 \\ \hline 24593 \\ 3 \\ \hline 73779 \\ 12 \\ \hline 885348 \text{ inches} \end{array}$$

(7)...

| | | days |
|---|---|---|
| July contains | | 31 |
| August | ,, | 31 |
| Sept. | ,, | 30 |
| Oct. | ,, | 31 |
| Nov. | ,, | 30 |
| Dec. | ,, | 31 |

$$\begin{array}{r} \hline 184 \\ 24 \\ \hline 736 \\ 368 \\ \hline 4416 \\ 60 \\ \hline 264960 \text{ min.} \end{array}$$

(8)...

|  |  | £ | s. | d. |
|---|---|---|---|---|
| 37 gui. | = | 38 | 17 | 0 |
| 19 sov. | = | 19 | 0 | 0 |
| 37 hf. cr. | = | 4 | 12 | 6 |
| 33 fl. | = | 3 | 6 | 0 |
| 79 sh. | = | 3 | 19 | 0 |
|  |  | £69 | 14 | 6 |

(9)...

|  | s. | d. |  |
|---|---|---|---|
|  | 17 | 9¾ | =855 far. |
| £82 | 16 | 6¾ | =79515 far. |

79515÷855=93 times

(10)...

$$3\tfrac{3}{4} \text{ yds.} = 15 \text{ qrs.}$$
$$56\tfrac{1}{4} \text{ yds.} = 225 \text{ qrs.}$$

$$225÷15 = 15 \text{ shirts}$$

## EXERCISE II.

(1)...   See "*Answers.*"

(2)...  
gui.
$7897 \times 21 \times 12 \times 4 = 7960176$ farthings

(3)...

hf. cr.
$$\begin{array}{r} 14 \\ 30 \\ \hline 4)420 \\ \hline 105 \text{ fourpenny-pieces} \end{array}$$

(4)...

| oz. | dwt. |
|---|---|
| 119 | 17 |

$$\begin{array}{r} 20 \\ \hline 2397 \\ 24 \\ \hline 9588 \\ 4794 \\ \hline 57528 \text{ grains} \end{array}$$

```
           inches                              qrs. bu. pks.
(5)...  12)2914367              (6)...   27   5   3
        3) 242863   11 in.                  8
          80954     1 ft.                 221
              2                             4
5½ × 2 = 11)161908                         887
         40)14718  10 hf. yds. = 5 yds.      2
          8) 367   38 poles               1774 gallons
            45     7 fur.
```

*Ans.*    45 mi. 7 fur. 38 po. 5 yds. 1 ft. 11 in.
     = 45 mi. 7 fur. 39 po. 5 in.

```
(7)...60)139292 min.                        £   s.  d.
       24) 2321  32 min.    (8)...33 hf. gui. = 17  6   6
        7) 96    17 hrs.          119 hf. cr. = 14 17   6
          13      5 days                       £2  9   0
```

*Ans.* 13 wks. 5 days 17 hrs. 32 min.

```
    £   s.  d.                               £   s.  d.
(9)...19 17 6¾              (10)...   17  16  6
         4 × 7 + 1 = 29                   20
     79 10  3                            356
          7                     d.        12
    556 11  9              7s. 9d. = 93)4278(46 yards
     19 17  6¾                           372
    £576  9  3¾                           558
                                          558
```

## EXERCISE III.

```
(1)...      437 divisor     (2)...   735 fourpences
            129 quotient             4
           3933                   30)2940
            874                      98 half-crowns
            437
             78 remainder
          56451 dividend
```

(3)...     27½ guineas          (4)...   16)1000000 ounces
            2                              28) 62500
           ―――――                          ―――――――――
           55 half-guineas               4) 2232  4 lb.
           21                            ―――――――――
           ――                           20) 558  0  4
           55                           ――――――――――――
          110                              27 18  0  4
          ―――――                 *Ans.* 27 tons 18 cwt. 4 lb.
          1155 sixpences

           lb. oz. dwt. grs.                    ac. ro. po.
(5)...     75   7  19  17      (6)...   11  3  25
           12                            4
          ―――                          ――
          907                          47
           20                          40
         ―――――                       ――――
         18159                        1905
           24                          30¼
        ―――――                        ――――――
        72653                        57150
        36318                         476¼
        ――――――――――                  ――――――――
        435833 grains               57626¼ sq. yds.

                      days
(7)...   June contains 30    (8)...  1 mile = 5280 feet
         July     „    31                    87
         August   „    31                 ―――――――
         Sept.    „    30                  36960
                 ―――――                    42240
                  122              31680)459360(14 ft. 6 in.
                   24                     31680
                 ―――――                   ――――――
                  488                     142560
                 244                      126720
                ―――――                     ――――――
                2928                       15840
                  60                         12
              ――――――――――                   ―――――――
              175680 minutes   31680)190080(6 in.
                                      190080
                                     ―――――――

$£$ $s.$ $d.$
(9)...73)188 19 3¼(£2 11s. 9¼d.
146

$\overline{42}$

20

73)$\overline{859}$(11s.

803

$\overline{56}$

12

73)$\overline{675}$(9d.

657

$\overline{18}$

4

73)$\overline{73}$(1 far.

73

$£$ $s.$ $d.$
(10)...250 gui. = 262 10 0

16 2 6

$\overline{246\ \ 7\ \ 6}$

20

365)$\overline{4927}$(13s. 6d.

365

$\overline{1277}$

1095

$\overline{182}$

12

365)$\overline{2190}$(6d.

2190

## EXERCISE IV.

(1)... See "*Answers.*"

(2)...
$\quad$ $s.$
$\quad$ 379 gui. = 7959
$\quad$ 219 sov. = 4380
$\quad$ 423 cr. = 2115
$\quad$ 177 fl. = 354
$\quad$ 689 sh. = 689
$\quad$ $\overline{15497}$
$\quad$ 12
$\quad$ $\overline{185964}$
$\quad$ 4
$\quad$ $\overline{743856}$ far.

(4)...
$\quad$ 1964327
$\quad$ 35
3036)$\overline{1964292}$(647 divisor
$\quad$ 18216
$\quad$ $\overline{14269}$
$\quad$ 12144
$\quad$ $\overline{21252}$
$\quad$ 21252

(3)...
$\quad$ gui.
$\quad$ 285
1 gui. = 42 sixpences
$\quad$ $\overline{570}$
1140
5)$\overline{11970}$
$\quad$ $\overline{2394}$ half-crowns

(5)...
$\quad$ t. cwt. lb. oz.
$\quad$ 23 13 19 11
$\quad$ 20
$\quad$ $\overline{473}$
$\quad$ 112
$\quad$ $\overline{965}$
$\quad$ 473
$\quad$ 473
$\quad$ $\overline{52995}$
$\quad$ 16
$\quad$ $\overline{317981}$
$\quad$ 52995
$\quad$ $\overline{847931}$ ounces

(6)...
| qrs. | bu. | pks. | gal. |
|---|---|---|---|
| 27 | 5 | 3 | 1 |

```
        8
      ───
      221
        4
      ───
      887
        2
     ────
     1775
        8
    ─────
    14200 pints
```

(7)...1 acre = 4840 sq. yds.

$$5\tfrac{1}{4}$$
```
   24200
    1210
168)25410(151¼ yds.
   168
   ───
   861
   840
   ───
   210
   168
   ───
    42
   ─── = ¼
   168
```

(8)...
```
          s.  d.
         28   9
         12
        ────
        345
         13
        ────
        1035
```

```
  s.  d.    d. 345
  3  10 = 46)4485(97½ lb.
             414
             ───
             345
             322
             ───
              23    1
             ─── = ─
              46    2
```

(9)...£7 15 5¼ = 7461 farthings

£334 3 9¾ = 320823 farthings

320823÷7461 = 43 times

(10)...
|  |  | £ | s. | d. |
|---|---|---|---|---|
| 7 sov. | = | 7 | 0 | 0 |
| 19 hf. sov. | = | 9 | 10 | 0 |
| 47 hf. cr. | = | 5 | 17 | 6 |
| 29 fl. | = | 2 | 18 | 0 |
| 117 sh. | = | 5 | 17 | 0 |
| 93 sixp. | = | 2 | 6 | 6 |
| 59 fourp. | = | 0 | 19 | 8 |
| 37 threep. | = | 0 | 9 | 3 |
| 15 pence | = | 0 | 1 | 3 |
| 18 halfp. | = | 0 | 0 | 9 |
|  |  | £34 | 19 | 11 |

## EXERCISE V.

(1)...
```
    19015034
     3070055
    ────────
    15944979
```

(2)...
```
              d.
17 hf. gui. = 2142
29 hf. cr.  = 870
13 fl.      = 312
23 sh.      = 276
            ─────
           4)3600
            ─────
            900 fourp.
```

(3)... £11 17s. 6d. = 2850 pence

2850÷50 = 57 dollars

```
          t.   cwt. qrs. lb.  oz.              mi.  fur.  po.
(4)...    19   17   3    19   11      (5)...   37   5    19
          20                                    8
         ───                                  ───
         397                                  301
           4                                   40
        ────                                 ─────
        1591                                 12059
          28                                   5½
       ─────                                ─────
       12747                                60295
        3182                                 6029½
       ─────                                ──────
       44567                                66324½
          16                                   3
      ──────                               ───────
      267413                               198973½
      44567                                   12
      ──────                               ───────
      713083 ounces                        2387682 inches
```

```
         sec.                           £    s.   d.
(6)...60)85693495        (7)...97)359  16   2¼(£3 14s. 2¼d.
      60)1428224  55 sec.          291
      24)  23803  44 min.          ───
         ───  991  19 hours         68
                                    20
Ans. 991 dys. 19 h. 44 m. 55 sec. 97)1376(14s.
                                    97
                                   ────
                                   406
                                   388
                                   ───
                                    18
                                    12
                                   ───
          s.  d.  s.  s.  d.  s.  d.   97)218(2d.
(8)...2   6 + 2 + 1 + 4 = 5   10      194
                      = 70 pence       24
          5 gui. = 1260 pence           4
                                       ───
      1260 ÷ 70 = 18 of each coin    97)97(1 far.
                                      97
                                      ──
```

```
                                              da.
(9)...    £567 15s. = £567¾      (10)...    135
                        7                    10½
                    ─────────               ─────
                 12)3974¼                   1350
                 20)331   2¼                  67½
                    ────                  ────────
                    £16   11   2¼        12)1417½
                                         20)118   1½
                                            ────
                                            £5   18   1½
```

## EXERCISE VI.

(1)...
```
        279
        553
        837
       1395
       1395
   79)154287(1953
      79
      752
      711
      418
      395
      237
      237
```

(2)...
```
        hf. cr.
         86
         30
      4)2580
        645 fourpenny-pieces
```

(3)...
```
          far.
       4)298765
      12)74691¼
      20)6224  3¼
       £311  4s. 3¼d.
```

(4)...
```
   lb.  oz. dwt. grs.
   23    9   17   21
   12
  285
   20
 5717
   24
22889
11434
137229 grains
```

(5)...
```
          inches
     12)8432765297
      3)702730441  5 in.
   1760)234243480  1 ft.(133092 mi.
        1760
        5824
        5280
        5443
        5280
       16348
       15840
        5080
        3520
        1560 yards
```
*Ans.* 133092 mi. 1560 yds. 1 ft. 5 in.

(6)..
```
     ac.  ro.  po.
      7    2   19
      4
     30
     40
   1219
     30¼
  36570
    304¾
  36874¾ sq. yards
```

(7)...
```
             £   s.   d.
            89   12   7½
  57½ gui. = 60    7   6
            £29    5   1½
```

(8)...
```
      3 tons 9 cwt. 5 lb. = 7733 lb.
      1 cwt. 3 qrs. 13 lb. = 209 lb.

        7733÷209 = 37
```

(9)...              10 oz. 12 dwt. 15 grs. = 5103 grs.
                    6 lb. 5 oz. 19 dwt. 6 grs. = 37422 grs.
                        $37422 \div 5103 = 7\frac{1}{3}$ dozen
                                        = 88 spoons

                                                    *s.*      *d.*
(10)...   3 doz. Port   at 45*s*. 6*d*. per doz. = 136    6
          4 doz. Sherry at 37*s*. 9*d*.    „      = 151    0
                                                  ‾‾‾‾‾‾‾‾‾‾
                                                   287    6

                        *s.*  *d.*    *d.*   12
                        3   10  =  46)3450(75 lb.
                                     322
                                    ‾‾‾‾
                                     230
                                     230
                                    ‾‾‾‾

## *EXERCISE VII.*

                        £   *s.*  *d.*                        mi. fur. yds. ft.
(1)...23 gui.  = 24   3   0      (2)...35½ miles = 35   4    0   0
      37 sov.  = 37   0   0                       19   7  175   2
      55 cr.   = 13  15   0                      ‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾
      31 fl.   =  3   2   0                       15   4   44   1
      53 sixp. =  1   6   6              cwt. qrs. lb.  oz.
      79 pence =  0   6   7      (3)...   17  3  19    9
                 ‾‾‾‾‾‾‾‾‾‾                               $3 \times 6 = 18$
                 £79  13   1                       ‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾
                                                    2  13  3   2  11
                                                                6
                                                 tons ‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾
                                                      16  2  2  16   2

(4)...                   ac.  ro.  per.          E. ells qrs. na.
              45 $\begin{cases} 5)39 & 3 & 30 \\ \overline{9)7} & 3 & 38 \\ \overline{\phantom{9)7}} & 3 & 22 \end{cases}$      (5)...   19   3   2
                                                             5
                                                           ‾‾‾‾
                                                            98
                                                             4
                                                           ‾‾‾‾
                                                           394
           *s.*  *d.*                                       2¼
(6)...   1   6                                             ‾‾‾‾
            $3 \times 6 + 1\frac{1}{2} = 19\frac{1}{2}$    788
         ‾‾‾‾                                              98½
         4   6                                            ‾‾‾‾‾‾
            6                                             886½ inches
        ‾‾‾‾
        1   7   0
            1   6
                9
       ‾‾‾‾‾‾‾‾‾‾
       £1  9   3

(7)...
$$\begin{array}{ll} \text{yds.} & \text{yds.} \\ 2\frac{3}{8} & 33\frac{1}{4} \\ 8 & 8 \\ \hline 19 & 19)\overline{266}(14 \text{ pairs} \\ & 19 \\ & \overline{76} \\ & 76 \\ & \overline{\phantom{76}} \end{array}$$

(8)...
$$63\left\{\begin{array}{l} \begin{array}{ccc} £ & s. & d. \end{array} \\ 7)3 \quad 10 \quad 10\frac{1}{2} \\ 9)\overline{\quad 10 \quad 1\frac{1}{2}} \\ \overline{1 \quad 1\frac{1}{2}} \text{ per lb.} \end{array}\right.$$

(9)...
$$\begin{array}{l} \text{gal.} \\ 57 \\ 8 \\ \hline 456 \\ \text{pt. hf. pts. } 2 \\ 1\frac{1}{2} = 3)\overline{912} \text{ half pints} \\ \overline{304} \text{ bottles} \end{array}$$

(10)...
$$\begin{array}{l} \begin{array}{ccc} £ & s. & d. \end{array} \\ 9)72 \quad 18 \quad 0 \\ 12)8 \quad \overline{2} \quad 0 \\ 6)\overline{\quad 13 \quad 6} \text{ per week each} \\ \overline{2 \quad 3} \text{ per day each} \end{array}$$

## EXERCISE VIII.

(1)...
$$\begin{array}{l} 13009046 \\ 560019 \\ \hline 12449027 \end{array}$$

(2)...
$$\begin{array}{l} \text{halfpence} \\ d. \; 2)9324 \\ \text{hf. gui.} = 126)\overline{4662}(37 \text{ half-guineas} \\ \phantom{\text{hf. gui.} = 126)}378 \\ \phantom{\text{hf. gui.} = 126)}\overline{882} \\ \phantom{\text{hf. gui.} = 126)}882 \\ \phantom{\text{hf. gui.} = 126)}\overline{\phantom{882}} \end{array}$$

(3)...
$$\begin{array}{l} \begin{array}{cccc} \text{t.} & \text{cwt.} & \text{qr.} & \text{lb.} \end{array} \\ 17 \quad 13 \quad 1 \quad 19 \\ 20 \\ \hline 353 \\ 4 \\ \hline 1413 \\ 28 \\ \hline 11323 \\ 2826 \\ \hline 39583 \\ 16 \\ \hline 237498 \\ 39583 \\ \hline 633328 \text{ ounces} \end{array}$$

(4)...
$$\begin{array}{l} \begin{array}{ccc} \text{ac.} & \text{ro.} & \text{per.} \end{array} \\ 13 \quad 0 \quad 27 \\ 4 \\ \hline 52 \\ 40 \\ \hline 2107 \\ 30\frac{1}{4} \\ \hline 63210 \\ 526\frac{3}{4} \\ \hline 63736\frac{3}{4} \text{ sq. yards} \end{array}$$

|     | cu. yds. | cu. ft. |
|-----|----------|---------|
| (5)... | 19 | 22 |
|     | 27 | |
|     | $\overline{155}$ | |
|     | 38 | |
|     | $\overline{535}$ | |
|     | 1728 | |
|     | $\overline{4280}$ | |
|     | 1070 | |
|     | 3745 | |
|     | 535 | |
|     | $\overline{924480}$ cubic inches | |

|     | qrs. | bu. | pks. |
|-----|------|-----|------|
| (6)... | 27 | 5 | 3 |
|     |    | 8 | |
|     |    | $\overline{221}$ | |
|     |    | 4 | |
|     |    | $\overline{887}$ | |
|     |    | 2 | |
|     |    | $\overline{1774}$ gallons | |

|        |        | £ | s. | d. |
|--------|--------|---|----|----|
| (7)... | 57 gui. | = 59 | 17 | 0 |
|        | 39 sov. | = 39 | 0 | 0 |
|        | 49 hf. cr. | = 6 | 2 | 6 |
|        | 27 fl. | = 2 | 14 | 0 |
|        | 73 sh. | = 3 | 13 | 0 |
|        |        | £1$\overline{11}$ | 6 | 6 |

|        | s. | d. |
|--------|----|----|
| (8)... | 3 | 8 |
|        |    | $7 \times 11 + 2 = 79$ |
|        | 1 5 | 8 |
|        |    | 11 |
|        | 14 2 | 4 |
|        | 7 | 4 |
| 8 oz. = | 1 | 10 |
| 2 oz. = |    | $5\frac{1}{2}$ |
|        | £14 11 | $11\frac{1}{2}$ |

(9)...
| s. | d. |
|----|----|
| 1 | 4 = one-fifteenth of £1 |

|    | £ | s. | d. |
|----|---|----|----|
| 15 { 3)57 | 15 | 0 | = 55 guineas |
|    5)19 | 5 | 0 | |
|    £3 | 17 | 0 | |

(10)...
| qrs. | bu. |
|------|-----|
| 10 | 4 |
|    | 8 |
| $\overline{84}$ | |
|    | 4 |
| $\overline{336}$ | |
|    | 4 |
| 3)$\overline{1344}$ quarter pecks | |
| 7)$\overline{448}$ | |
| $\overline{64}$ days | |

## EXERCISE IX.

(1)...    19 sov.   $=$    £    s.    d.    (2)...100 gui. $=$ 25200 pence
            19    0    0     £1    6    3 $=$ 315 pence
      37 hf. cr. $=$    4   12    6
             $\overline{23 \ 12 \ \ 6}$    25200÷315 $=$ 80 portions
               20
            $\overline{472}$
              12                  £    s.    d.
           $\overline{5670}$    (3)...84 $\begin{cases} 7)69 \ \ 6 \ \ 0 \\ 12)\overline{9 \ 18 \ \ 0} \end{cases}$
              4                       $\overline{16 \ \ 6}$ per gal.
        $\overline{22680}$ far.

          s.    d.                    oz.
(4)...         4    6          (5)...    16)27563
             $3 \times 9 = 27$           28)$\overline{1722}$   11 oz.
        $\overline{13 \ \ 6}$                4)$\overline{61}$   14 lb.
          9                  $\overline{15}$   1 qr.
      $\overline{6 \ \ 1 \ \ 6}$
¾ yd. $=$    3   4½        *Ans.* 15 cwt. 1 qr. 14 lb. 11 oz.
      £6    4   10½

(6)...    2 oz. 3 dwt. 6 grs. $=$ 1038 grains
      19 oz. 9 dwt. 6 grs. $\times 6 =$ 116 oz. 15 dwt. 12 grs.
                     $=$ 56052 grains
       56052÷1038 $=$ 54 spoons

               in.                 yds.
(7)...           643½        (8)...    17
               4                  13
   in.                              $\overline{51}$
$2\frac{1}{4} \times 4 = 9)\overline{2574}$             17
        4)$\overline{286}$               $\overline{221}$
         4)$\overline{71}$ 2 na.            9
          $\overline{17}$ 3 qrs.         $\overline{1989}$ sq. feet
    *Ans.* 17 yds. 3 qrs. 2 na.

                              s.   d.    s.
       (10)...10 gl. at 15   6$=$155
                   12    „    16   3$=$195
      £   s.   d.       14    „    17   0$=$238
(9)...9)10   2   6        $\overline{36}$            36 $\begin{cases} 6)\overline{588} \\ 6)\overline{98} \end{cases}$
   12)$\overline{1 \ \ 2 \ \ 6}$ per doz.
       $\overline{1 \ 10\frac{1}{2}}$ per pair                $\overline{16s. \ 4d.}$ per gal.

*EXERCISE X.*

(1) (2)...See "*Answers.*"

|  | hf. cr. |
|---|---|
| (3)... | 294 |
|  | 5 |

$$\text{hf. gui.} = 21 \begin{cases} \text{sixp.} & 3)\overline{1470} \\ & 7)\overline{490} \end{cases}$$

70 hf. gui.

|  | far. |
|---|---|
| (4)... | 4)7296859 |
|  | 12)$\overline{1824214\frac{3}{4}}$ |
|  | 20)$\overline{152017\ 10\frac{3}{4}}$ |
|  | £7600 17*s.* 10$\frac{3}{4}$*d.* |

|  | mi. | fur. | per. | yds. |
|---|---|---|---|---|
| (5)... | 15 | 3 | 29 | 4$\frac{1}{2}$ |
|  | 8 |  |  |  |

.$\overline{123}$

40

$\overline{4949}$

5$\frac{1}{2}$

$\overline{24749\frac{1}{2}}$

2474$\frac{1}{2}$

$\overline{27224}$

3

$\overline{81672}$

12

$\overline{980064}$ inches

|  | wks. | da. | hrs. |
|---|---|---|---|
| (6)... | 17 | 5 | 19 |
|  | 7 |  |  |

$\overline{124}$

24

$\overline{515}$

248

$\overline{2995}$

60

$\overline{179700}$ minutes

|  | £ | *s.* | *d.* |
|---|---|---|---|
| (7)... | 19 | 13 | 5$\frac{3}{4}$ |

$3 \times 7 \times 11 = 231$

$\overline{59\quad 0\quad 5\frac{1}{4}}$

7

$\overline{413\quad 3\quad 0\frac{3}{4}}$

11

£4544 13 8$\frac{1}{4}$

|  | mi. | fur. |
|---|---|---|
| (8)... | 17 | 5 |
|  | 8 |  |

$\overline{141}$

220

$\overline{2820}$

282

$\overline{31020}$

3

16920)$\overline{93060}$(5 ft. 6 in.

84600

$\overline{8460}$

12

16920)$\overline{101520}$(6 in.

101520

(9)...$34\frac{3}{4}$ yds. × 7 = $243\frac{1}{4}$ yds.

<div style="padding-left:2em">

$\begin{array}{rr} s. & d. \\ 11 & 9 \end{array}$

$3 \times 9 \times 9 = 243$

$\overline{\begin{array}{rr} 1\ 15 & 3 \\ & 9 \end{array}}$

$\overline{\begin{array}{rr} 15\ 17 & 3 \\ & 9 \end{array}}$

$\overline{142\ 15\quad 3}$

$\frac{1}{4}$ yd.= $\quad 2\ \ 11\frac{1}{4}$

$\overline{£142\ 18\quad 2\frac{1}{4}}$

</div>

(10)...1 mile = 5280 feet

<div style="padding-left:4em">
$\quad\quad 11$

$\overline{58080}$

in. $\quad 12$

2 ft. 6 in. = $30)\overline{696960}$

$\overline{23232}$ steps
</div>

## *EXERCISE XI.*

(1)...163 gui. = $163 \times 21 \times 12 =$ pence $41076$
217 sov. = $217 \times 20 \times 12 = 52080$
73 hf. cr.= $73 \times 30 \quad = 2190$
125 sh.  = $125 \times 12 \quad = 1500$
$\overline{96846}$
$\quad\quad\quad 4$
$\overline{387384}$ far.

(2)...774
178
$2)\overline{596}$
$\overline{298}$ less no.
178
$\overline{476}$ greater no.

$476 \times 298 = 141848$

(3)... inches
$12)\overline{1488960}$
$\overline{3)124080}$
$1760)\overline{41360}(23\frac{1}{2}$ miles
3520
$\overline{6160}$
5280
$\overline{880}$
$\overline{1760} = \frac{1}{2}$

(4)... sq.yds. sq.ft.
$\quad 33 \quad 7$
$\quad\quad\quad 9$
$\overline{\quad 304}$
$\quad 144$
$\overline{1216}$
1216
304
$\overline{43776}$ sq. inches

(5)... qrs. bu. pks.
$\quad 29 \quad 5 \quad 3$
$\quad\quad 8$
$\overline{237}$
$\quad 4$
$\overline{951}$
$\quad 2$
$\overline{1902}$ gallons

(6)... $\begin{array}{rrr} £ & s. & d. \\ 19 & 13 & 9\frac{3}{4} \end{array}$
$7 \times 7 = 49$
$\overline{137\ \ 16\quad 8\frac{1}{4}}$
$\quad\quad\quad\quad 7$
$\overline{£964\ \ 16\quad 9\frac{3}{4}}$

$$
(7)\ldots 63
\begin{cases}
\overline{\phantom{x}}\ \pounds\quad s.\quad d. \\
7)483\quad 3\quad 11\tfrac{1}{4} \\
\overline{9)69\quad 0\quad 6\tfrac{3}{4}} \\
\overline{\pounds 7\quad 13\quad 4\tfrac{3}{4}}
\end{cases}
$$

(8)...
| wks. | da. | hrs. | min. | |
|---|---|---|---|---|
| 84 | 3 | 16 | 35 | =852035 min. |
| 3 | 4 | 17 | 25 | = 37045 min. |

852035 ÷ 37045 = 23

(10)...
$$
\begin{array}{rr}
s. & d. \\
15 & 9 \\
12 \\
\hline
189 & 0 \\
12 \\
\hline
2268 \\
2 \\
\hline
\end{array}
$$

$$
(9)\ldots\quad
\begin{array}{c}
\text{lb.\quad lb.\quad lb.\quad lb.\quad qr.\ lb.} \\
1 + \tfrac{1}{2} + \tfrac{1}{4} = 1\tfrac{3}{4} = 7 \\
\text{lb.} \\
89\tfrac{1}{4} \\
4 \\
\hline
7)357 \\
\hline
51 \text{ of each}
\end{array}
$$

$$
\begin{array}{l}
d.\quad hf.\ d. \\
13\tfrac{1}{2} = 27)4536(168 \text{ yards} \\
\phantom{13\tfrac{1}{2} = }27 \\
\phantom{13\tfrac{1}{2} =}\overline{183} \\
\phantom{13\tfrac{1}{2} =}162 \\
\phantom{13\tfrac{1}{2} =}\overline{216} \\
\phantom{13\tfrac{1}{2} =}216 \\
\phantom{13\tfrac{1}{2} =}\overline{\phantom{216}}
\end{array}
$$

## EXERCISE XII.

(1)...
| | £ | s. | d. |
|---|---|---|---|
| 1000 sov. = | 1000 | 0 | 0 |
| 1000 sh. = | 50 | 0 | 0 |
| 1000 pence= | 4 | 3 | 4 |
| 1000 far. = | 1 | 0 | 10 |
| | £1055 | 4 | 2 |

(2)...
$$
\begin{array}{rrr}
\pounds & s. & d. \\
629 & 17 & 4 \\
20 \\
\hline
12597 \\
3 \\
\hline
37792 \text{ fourpenny-pieces}
\end{array}
$$

(3)... £2  13  2½ = 2553 far.
£124  19  9¾ = 119991 far.

119991 ÷ 2553 = 47 times

(4)...
$$
\begin{array}{rr}
oz. & dwt. \\
27 & 9 \\
7 \\
\hline
192 & 3 \\
20 \\
\hline
3843 \\
24 \\
\hline
15372 \\
7686 \\
\hline
92232 \text{ grains}
\end{array}
$$

(5)...
$$
\begin{array}{l}
\text{lb.} \\
28)356724 \\
\overline{4)12740}\quad 4 \text{ lb.} \\
\overline{20)3185} \\
\overline{159}\quad 5 \text{ cwt.}
\end{array}
$$

*Ans.* 159 tons 5 cwt. 4 lb.

(6)...
$$
\begin{array}{l}
\text{hands\quad in.} \\
16\quad 1 \\
4 \\
\hline
12)65 \\
\overline{5\text{ft. }5\text{ in.}}
\end{array}
$$

(7)...

         yds.

$22 \begin{cases} 2)\overline{1760} = 1 \text{ mile} \\ 11)\overline{880} \end{cases}$

           $\overline{80}$ chains

              ft.  ft.  ft.     cu. ft.

(8)... $7 \times 5 \times 3 = 105$

1 cubic foot = 1728 cu. in.

                105

               $\overline{8640}$

               1728

              $\overline{181440}$ cu. in.

         da. hrs. min. sec.

(9)...    9   17  35  25

                 $4 \times 7 = 28$

    $\overline{38\ \ 22\ \ 21\ \ 40}$

               7

   $\overline{272\ \ 12\ \ 31\ \ 40}$

               £.   s.   d.

(10)... $168 \begin{cases} 4)\overline{373\ \ 16\ \ \ 0} \\ 6)\overline{93\ \ \ \ 9\ \ \ 0} \\ 7)\overline{15\ \ 11\ \ \ 6} \end{cases}$

               £2   4   6 per acre

## EXERCISE XIII.

        t. cwt. qrs. lb.  oz.

(1)...    35   5    1  10   6

        23  13    0  23  14

       $\overline{11\ \ 12\ \ \ 0\ \ 14\ \ \ 8}$

(2)...    379 quotient

         257 divisor

       $\overline{2653}$

     1895

      758

         73 remainder

   $\overline{97476}$ dividend

                far.

(3) ..   1 sov.    = 960

    1 hf. sov. = 480

    1 cr.      = 240

    1 hf. cr.  = 120

           $\overline{1800}$

              17

        $\overline{12600}$

        1800

     $\overline{30600}$ farthings

               mi. fur.  yds.

(4)...   17   5   137

           8

       $\overline{141}$

      220

     $\overline{2957}$

     282

    $\overline{31157}$

        3

    $\overline{93471}$

      12

   $\overline{1121652}$ inches

          gal.  qts.

(5)...     17   3

          4

       $\overline{71}$

        2

    $\overline{142}$ pints

(6)...1 mile = 1760 yards

$\quad\quad\quad$ 133

$\quad\quad\quad\overline{5280}$

$\quad\quad\quad$ 5280

$\quad\quad\quad$ 1760

49280$\overline{)234080}$(4$\frac{3}{4}$ yards

$\quad\quad$ 197120

$\quad\quad\overline{36960}$ = $\frac{3}{4}$

$\quad\quad\overline{49280}$

(7)...£3  17  6$\frac{1}{4}$ = 3721 far.

$\quad$ £360  9  5$\frac{1}{4}$ = 346053 far.

346053 ÷ 3721 = 93 times

(8)...£536 15s. = £536$\frac{3}{4}$

$\quad\quad\quad\quad\quad\quad$ 7

$\quad\quad$ 12$\overline{)3757\frac{1}{4}}$

$\quad\quad\quad$ 20$\overline{)313}$  1$\frac{1}{4}$

$\quad\quad\quad\quad$ £15  13  1$\frac{1}{4}$

$\quad\quad\quad\quad\quad$ £  s.  d.

(9)...150 gui. = 157 10  0

$\quad\quad\quad\quad\quad$ 16  1  3

$\quad\quad\quad\quad\overline{141  8  9}$

$\quad\quad\quad\quad\quad$ 20

365$\overline{)2828}$(7s. 9d.

$\quad\quad$ 2555

$\quad\quad\overline{273}$

$\quad\quad$ 12

365$\overline{)3285}$(9d.

$\quad\quad$ 3285

$\quad\quad\quad\quad\quad\quad$ yds.

(10...$\quad$ 47$\frac{1}{4}$

$\quad\quad\quad\quad$ 12

$\quad\quad\quad\overline{567}$

yds. hf.-yds.  2

3$\frac{1}{2}$ = 7$\overline{)1134}$

$\quad\quad\quad\overline{162}$ shirts

## EXERCISE XIV.

$\quad\quad\quad$ bf. gui.

(1)...$\quad\quad$ 175

$\quad\quad\quad$ 21

$\quad\quad\quad\overline{175}$

$\quad\quad\quad$ 350

5$\overline{)3675}$

$\quad\overline{735}$ half-crowns

$\quad\quad\quad$ lb. oz. drs. scr. grs.

(2)...$\quad$ 29  9  5  2  17

$\quad\quad\quad$ 12

$\quad\quad\overline{357}$

$\quad\quad\quad$ 8

$\quad\overline{2861}$

$\quad\quad\quad$ 3

$\quad\overline{8585}$

$\quad\quad\quad$ 20

$\overline{171717}$ grains

c

(3)...   16)3467163   ounces

       28)216697   11 oz.

        4) 7739   5 lb.

       20)1934   3 qrs.

          96   14 cwt.

(4)...  
$$\begin{array}{rr} s. & d. \\ 1 & 8 \end{array}$$
$5 \times 7 = 35$
$$\begin{array}{rr} 8 & 4 \\ & 7 \\ \hline 2\ \ 18 & 4 \end{array}$$

*Ans.* 96 tons 14 cwt. 3 qrs. 5 lb. 11 oz.

(5)...   $18 \begin{cases} 3)10\ \ 1\frac{1}{2} \\ \overline{6)3\ \ \ 4\frac{1}{2}} \end{cases}$

                $6\frac{3}{4}d.$ per lb.

$$\begin{array}{rr} s. & d. \\ 3 & 6 \end{array}$$
$5 \times 9 = 45$
$$\begin{array}{rr} \hline 17 & 6 \\ & 9 \\ \hline 7\ \ 17 & 6 \\ 2\ \ 18 & 4 \\ \hline £10\ \ 15 & 10 \end{array}$$

(6)...2 lb. 12 oz. = 44 oz.

   16 cwt. 2 qrs. = 29568 oz.

     29568÷44 = 672 parcels

(7)...  
$$\begin{array}{rr} s. & d. \\ 4 & 6 \end{array}$$
$5 \times 10 = 50$
$$\begin{array}{rr} \hline 1\ \ 2 & 6 \\ & 10 \end{array}$$
$30 \begin{cases} 5)11\ \ 5\ \ 0 \\ \overline{6)2\ \ \ 5\ \ 0} \end{cases}$

               7   6 per yard

(8)...   
   cwt.  qrs.  lb.

     3   2   20

     4

    14

    28

   132

    28

  412 lb.

    4¼

  1648

   103

 12)1751

 20)145  11

   £7  5s. 11d.

(9)...   1 mile = 5280 feet

               sec.    30

1 hour = 3600)158400(44 feet

            14400

            14400

            14400

(10)...3795

     709

  2)3086

  1543 No. for unsuccessful c.

    709

  2252 No. for successful c.

*EXERCISE XV.*

<pre>
            far.                                ac.  ro.  po.
(1)...    4)7268439              (2)...    23    2   31
         12)1817109¾                                4
         20)151425   9¾                           94
           £7571   5s.   9¾d.                     40
                                              3791
                                                30¼
            £   s.  d.                       113730
(3)... Bank-note = 5   0   0                   947¾
       7 sov.    = 7   0   0                114677¾ sq. yards
       6 hf. sov. = 3   0   0
      59 hf. cr.  = 7   7   6                    gui.
      27 fl.      = 2  14   0         (4)...    55
      93 sh.      = 4  13   0         1 gui. = 42 sixpences
      71 sixpences= 1  15   6                 110
      46 fourp.   = 0  15   4      s.  d.  sixp. 220
      51 threep.  = 0  12   9      27  6 = 55)2310(42 weeks
      17 pennies  = 0   1   5                220
       5 halfp.   = 0   0   2½               110
                  £32  19   8½               110
</pre>

(5)...    7 ac. 4295 sq. yds. = 38175 sq. yds.
          16 per. 25 sq. yds. = 509 sq. yds.

          38175÷509 = 75 allotments

<pre>
        s.   d.             (7)...  65½ doz. = 786 bottles
(6)... 13   6                       £    s.
       11   9                      91   14
        1   9 profit on 1 yd.      20
        5×5×7 = 175          786)1834(2s. 4d. per bottle
        8   9                     1572
            5                      262
        2   3   9                  12
            7              786)3144(4d.
      £15   6   3                 3144
</pre>

(8)...$\underset{\text{yds.}}{181\frac{1}{2}} \times \underset{\text{yds.}}{140} = 25410$ sq. yds.

$\qquad = 5\frac{1}{4}$ acres

$$\begin{array}{r} \pounds \quad s. \quad d. \\ 50 \text{ guineas} = 52 \quad 10 \quad 0 \\ 5\frac{1}{4} \\ \hline 262 \quad 10 \quad 0 \\ 13 \quad 2 \quad 6 \\ \hline \pounds 275 \quad 12 \quad 6 \end{array}$$

(9)...4 cwt. 3 qrs. = 532 lb.

$$\begin{array}{r} 532 \\ 5 \\ \hline 12)\overline{2660} \\ 20)\overline{221} \quad 8 \\ \hline 11 \quad 1 \quad 8 \text{ selling price} \\ 9\frac{1}{2} \text{ gui.} = \quad 9 \quad 19 \quad 6 \text{ cost price} \\ \hline \pounds 1 \quad 2 \quad 2 \text{ profit} \end{array}$$

(10)...    5 times in 6 sec. $= \underset{\text{times}}{50}$ per minute

$$\begin{array}{r} 60 \\ \hline 3000 \text{ per hour} \\ 24 \\ \hline 72000 \text{ per day} \\ 7 \\ \hline 504000 \text{ per week} \end{array}$$

## EXERCISE XVI.

(1)...
$$\begin{array}{r} \text{far.} \\ 4)\overline{14280} \\ \hline 30)\overline{3570} \\ \hline 119 \text{ half-crowns} \end{array}$$

(2)...$81 \left\{ \begin{array}{r} \pounds \quad s. \quad d. \\ 9)\overline{18 \quad 11 \quad 3} \\ 9)\overline{2 \quad 1 \quad 3} \\ \hline 4 \quad 7 \text{ per pair} \end{array} \right.$

(3)...
$$\begin{array}{r} \text{mi. fur. yds.} \\ 43 \quad 3 \quad 56 \\ 19 \quad 7 \quad 175 \\ \hline 23 \quad 3 \quad 101 \end{array}$$

(4)...$36 \left\{ \begin{array}{r} \text{lb. oz. dwt. grs.} \\ 6)\overline{203 \quad 9 \quad 1 \quad 12} \\ 6)\overline{33 \quad 11 \quad 10 \quad 6} \\ \hline 5 \quad 7 \quad 18 \quad 9 \end{array} \right.$

(5)...
$$\begin{array}{r} \text{ac. ro. po.} \\ 9 \quad 3 \quad 27 \\ 13 \quad 0 \quad 35 \\ 11 \quad 2 \quad 19 \\ 7 \quad 1 \quad 15 \\ 19 \quad 0 \quad 25 \\ 8 \quad 3 \quad 15 \\ 12 \quad 2 \quad 0 \\ \hline 82 \quad 2 \quad 16 \end{array}$$

(6)...
$$\begin{array}{r} s. \quad d. \qquad \pounds \quad s. \quad d. \\ 1\frac{1}{2} \text{ doz. at } 47 \quad 6 = 3 \quad 11 \quad 3 \\ 2\frac{1}{2} \text{ doz. at } 38 \quad 6 = 4 \quad 16 \quad 3 \\ \hline \pounds 8 \quad 7 \quad 6 \end{array}$$

(7)...　1 acre = 4840 sq. yards

$$\underline{\phantom{4840}5\tfrac{1}{4}}$$

$$\underline{24200}$$

$$\underline{1210}$$

$$35 \left\{ \begin{array}{l} 5)\overline{25410} \\ \overline{7)5082} \end{array} \right.$$

$$\overline{726 \text{ trees}}$$

(8)...
| | s. | d. | |
|---|---|---|---|
| | 1 | 9 | per day |
| | | 6 | |
| | 10 | 6 | per week |
| | | 7 | |
| | 3 13 | 6 | |
| | | 9 | |
| £33 | 1 | 6 | |

(9)...
| £ | s. | d. |
|---|---|---|
| 24 | 14 | 4½ |
| 20 | | |

$$\overline{494}$$

$$\underline{12}$$

$$7)\overline{5932\tfrac{1}{2}}$$

$$\overline{847\tfrac{1}{2}} = £847 \ 10s.$$

(10)...　2¼ tons = 45 cwt.

| £ | s. | d. |
|---|---|---|

$$45 \left\{ \begin{array}{l} 5)1 \quad 8 \quad 1\tfrac{1}{2} \\ 9) \quad \ \ 5 \quad 7\tfrac{1}{4} \end{array} \right.$$

$$7\tfrac{1}{2}d. \text{ per cwt.}$$

## EXERCISE XVII.

(1)...
| | £ | s. | d. |
|---|---|---|---|
| 19 gui. | = 19 | 19 | 0 |
| 13 sov. | = 13 | 0 | 0 |
| 25 hf.-cr. | = 3 | 2 | 6 |
| | 36 | 1 | 6 |
| | 20 | | |

$$\overline{721}$$

$$\underline{12}$$

$$\overline{8658}$$

$$\underline{4}$$

$$\overline{34632} \text{ far.}$$

$$441 \left\{ \begin{array}{l} 7)3378 \ 14 \ 0\tfrac{3}{4} \\ 7)482 \ 13 \ 5\tfrac{1}{4} \\ 9)68 \ 19 \ 0\tfrac{3}{4} \end{array} \right.$$

$$\overline{£7 \ 13 \ 2\tfrac{3}{4}}$$

(2)...441)
| £ | s. | d. | £ | s. | d. |
|---|---|---|---|---|---|
| 3378 | 14 | 0¾ | (7 | 13 | 2¾ |

$$\underline{3087}$$

$$\overline{291}$$

$$\underline{20}$$

$$441)\overline{5834}(13s.$$

$$\underline{441}$$

$$\overline{1424}$$

$$\underline{1323}$$

$$\overline{101}$$

$$\underline{12}$$

$$441)\overline{1212}(2d.$$

$$\underline{882}$$

$$\overline{330}$$

$$\underline{4}$$

$$441)\overline{1323}(3 \text{ far.}$$

$$\underline{1323}$$

(3)...
```
      ac.  ro.  po.
      13   3    15
       4
      55
      40
      2215
       30¼
      66450
       553¾
      67003¾ sq. yards
```

(5)...
```
      £  s.  d.
      1  12  6
             5×5 = 25
      8  2   6
             5
 30 { 5)40 12 6
    {  6)8  2  6
     £1  7  1 per gallon
```

(7)...
```
25 perches = 756¼ sq. yds.
           = 6806¼ sq. ft.
           = 980100 sq. in.
980100÷180 = 5445 cabbages
```

(8)...
```
              s.  d.   £  s.  d.
18¾ yds. silk velvet 7  6  = 7  0  7½
3½  „    cloth      12  9  = 2  4  7½
                          £9  5  3
```

(9)...
```
      ac. ro.  po.
17)60  3   4(3 ac. 2 ro. 12 po.
   51
    9
    4
17)39(2 ro.
   34
    5
   40
17)204(12 po.
   204
```

(4)...
```
      cwt. qrs. lb.
      2    3   21
      4
      11
      28
      329 lb.
       15½
      1645
      329
      164½
   12)5099½
   20)424 11½
     £21  4 11½
```

(6)...
```
      £  s.  d.
      2  3   6
             6×6×10+5 = 365
      13 1   0
             6
      78 6   0
            10
      783 0  0
      10 17  6
      793 17 6 yearly expenditure
      350 0  0
    £1143 17 6 yearly income
```

(10)...
```
         gal.
         250 per hour
          24
         1000
         500
   360)6000(16⅔ gal.
      360
      2400
      2160
       240
       ─── = ⅔
       360
```

*EXERCISE XVIII.*

(1)...
$$£$$
$$735$$
$$20$$
$$21)\overline{14700}$$
$$\overline{700}\text{ guineas}$$

(2)...
$$\text{grains}$$
$$20)\overline{5968341}$$
$$3)\overline{298417}\quad 1\text{ gr.}$$
$$8)\overline{99472}\quad 1\text{ scr.}$$
$$12)\overline{12434}$$
$$\overline{1036}\quad 2\text{ oz.}$$

*Ans.* 1036 lb. 2 oz. 0 dr. 1 scr. 1 gr.

(3)...
|t.|cwt.|qrs.|lb.|oz.|
|---|---|---|---|---|
|17|13|2|23|13|
|25|11|1|19|7|
|13|17|2|11|9|
|57|2|2|26|13|

(4)...   2 qrs. 11½ lb.=135 hf. lb.
1 ton 7 cwt. 2 qrs 25 lb.=6210 hf. lb.

6210÷135=46 parcels

(5)...
$$\text{yards}\qquad\text{fur.}$$
$$220)\overline{49025}(8)222$$
$$440\qquad\qquad \overline{27}\text{ mi. 6 fur.}$$
$$\overline{502}$$
$$440$$
$$\overline{625}$$
$$440$$
$$\overline{185}\text{ yards}$$

(6)...¾ mile = 1320 yards
$$\text{qrs.}\quad\overline{4}$$
$$2\tfrac{3}{4}\text{ yds.}=11)\overline{5280}$$
$$\overline{480}\text{ times}$$

*Ans.* 27 mi. 6 fur. 185 yds.

(7)
|cu. yds.|cu. ft.|
|---|---|
|43|19|
|27||
|320||
|86||
|1180||
|1728||
|9440||
|2360||
|8260||
|1180||
|2039040|cu. inches|

(8)...
$$56\left\{\begin{array}{l}£\quad s.\quad d.\\ 7)\overline{10\quad 14\quad 8}\\ 8)\overline{1\quad 10\quad 8}\\ \overline{3\quad 10}\text{ per lb.}\end{array}\right.$$

(9)... 3 yds. 3 qrs. 2 na.=62 nails
34 yds. 3 qrs. 2 na.=1674 nails

1674÷62=27 suits

(10)...               25+17 = 42 sheep
$$£\quad s.\quad d.$$
42 sheep at 1½ gui. each = 66   3   0
£36+£25 = 61   0   0
profit = £5   3   0

## EXERCISE XIX.

(1)...

|  | qrs. | lb. | oz. |
|---|---|---|---|
|  | 3 | 17 | 8 |

$3 \times 9 = 27$

|  | 2 | 2 | 24 | 8 |
|---|---|---|---|---|
|  |  |  |  | 9 |
|  | 1 | 4 | 1 · 24 | 8 |

*Ans.* 1 ton 4 cwt. 1 qr. 24 lb. 8 oz.

(2)...

|  | £ | s. | d. |
|---|---|---|---|
|  | 153 | 19 | 2 |
|  | 20 |  |  |
|  | 3079 |  |  |
|  |  |  | 12 |

*d.*
$4s.\ 2d. = 50\overline{)36950}$

739 dollars

(3)...

$42 \begin{cases} 6)\overline{1\quad 9\quad 9} \\ 7)\overline{\phantom{00}4\ 11\frac{1}{2}} \end{cases}$ £ s. d.

$8\frac{1}{2}d.$ per lb.

(4)...

```
        yds.
        363
        126
       2178
        726
        363
       45738 sq. yards
           4
```

yds.     qrs.
$30\frac{1}{4} = 121 \begin{cases} 11)\overline{182952} \\ 11)\overline{16632} \end{cases}$

```
        40)1512
         4)37 32 per.
          9 ac. 1ro. 32 per.
```

(5)...Leap year contains 366

```
                          da.
              366
               24
             1464
              732
             8784 hrs.
```

(6)...$\frac{3}{4}$ acre = 3630 sq. yds.
$3s.\ 9d. =$ 45 pence

```
       18150
       14520
    12)163350
    20)13612  6
      £680 12s. 6d.
```

(7)...

|  | s. | d. |
|---|---|---|
|  | 14 | 6 |
|  |  | $13\frac{3}{4}$ |
|  | 188 | 6 |

$\frac{3}{4}$ yd. =

|  | 10 | $10\frac{1}{2}$ |
|---|---|---|
|  | 199 | $4\frac{1}{2}$ |
|  | 12 |  |
|  | 2392 |  |

s. d.  hf. d.       2
$3\ \ 7\frac{1}{2} = 87\overline{)4785}(55\text{ yards}$

```
         435
         435
         435
```

(8)...$5\frac{1}{2}$ gui.=
$$\begin{array}{ccc} \pounds & s. & d. \\ 5 & 15 & 6 \\ 2 & 6 & 6 \end{array}$$

$$108\left\{\begin{array}{l} 9)\underline{8\ \ 2\ \ 0} \\ 12)\underline{18\ \ 0} \end{array}\right.$$

$$4)\underline{1\ \ 6}\text{ per gal.}$$
$$4\tfrac{1}{2}d.\text{ per quart}$$

(9)...66 shillings = 33 florins.

$$33\left\{\begin{array}{l} \text{dwts.} \\ 3)240 = 1\text{ lb. Troy} \\ \overline{11)80} \end{array}\right.$$

$$\overline{7\text{ dwts. }6\tfrac{6}{11}\text{ grs.}}$$

(10)...
$$\begin{array}{lccc} & \pounds & s. & d. \\ 7\text{ bullocks} & 80 & 0 & 0 \\ 5s.\ \ 6d.\times16\times7 = & 30 & 16 & 0 \\ \text{total cost} = & \overline{110} & \overline{16} & \overline{0} \end{array}$$

$$\begin{array}{lccc} & \pounds & s. & d. \\ 130\text{ guineas} = & 136 & 10 & 0 \\ \text{cost} = & 110 & 16 & 0 \\ \text{profit } \pounds & \overline{25} & \overline{14} & \overline{0} \end{array}$$

## EXERCISE XX.

(1)...  1.  $973 - 462 + 197 - (149 + 76) + 1069 - 427$
$= 973 - 462 + 197 - 149 - 76 + 1069 - 427$
$= 2239 - 1114$
$= 1125$

2.  $\{2469 - (210 - 173) + 2063 - 209 + 1545\} \div 17$
$= (2469 - 210 + 173 + 2063 - 209 + 1545) \div 17$
$= (6250 - 419) \div 17$
$= 5831 \div 17$
$= 343$

(2)...
$$\begin{array}{cccccc} \text{t.} & \text{cwt.} & \text{qrs.} & \text{lb.} & \text{oz.} & \text{drs.} \\ 29 & 11 & 1 & 15 & 7 & 10 \\ 17 & 18 & 3 & 23 & 11 & 13 \\ \overline{11} & \overline{12} & \overline{1} & \overline{19} & \overline{11} & \overline{13} \end{array}$$

(3)...$\pounds866\ \ 6\ \ 10\tfrac{1}{2} = 831689$ far.
$\pounds11\ \ 17\ \ \ 4\tfrac{1}{4} = \ \ 11393$ far.

$831689 \div 11393 = 73$

(4)...
```
     ac.  ro.  per.
     29   3    29
         4
       ‾‾‾‾
       119
        40
      ‾‾‾‾‾
      4789
       30¼
    ‾‾‾‾‾‾‾
    143670
     1197¼
    ‾‾‾‾‾‾‾‾
    144867¼ sq. yards
```

(5)...
```
              sec.
     60)947291
      60)15788   11 sec.
       24)263    8 min.
         10     23 hrs.
```
*Ans.* 10 da. 23 hrs. 8 min. 11 sec.

(6)...
```
    qrs.  bu.  pks.
     4    4    3
       8
    ‾‾‾‾
     36
      4
    ‾‾‾‾
    147
      4
    3)588
    ‾‾‾‾
    196 days
```

(7)...
```
    1 mile = 1760 yards
              73½
           ‾‾‾‾‾‾
            5280
           12320
             880
           ‾‾‾‾‾‾
          129360
  £2 10s. =     50 sh.
    20)6468000
    ‾‾‾‾‾‾‾‾‾
    £323400
```

(8)...
```
            gui.
             20
             21
           ‾‾‾‾‾
            420
             12
3s. 9d. = 45d. { 5)5040
               { 9)1008
           ‾‾‾‾‾
            112 E. ells
              5
           4)560
           ‾‾‾‾‾
            140 yards
```

(9)...
```
           pence
            6½
          3 × 9 = 27
         1   7½
             9
        ‾‾‾‾‾‾
        14   7½
 ½ lb.   3¼
        ‾‾‾‾‾‾
        14  10¾ each box
             9
        ‾‾‾‾‾‾
    £6  14   0¾
```

(10)...
```
                                         £   s.   d.
    175 mince-pies at 3d. each     =     2   3    9
    175 buns at 14 for a shilling  =        12    6
    175 oranges at 9d. per dozen   =        10   11¼
                                         ‾‾‾‾‾‾‾‾‾‾‾
                                         £3   7    2¼
```

## EXERCISE XXI.

(1)...    4863)1843077(379
          14589
          ‾‾‾‾‾‾
          38417
          34041
          ‾‾‾‾‾‾
           43767
           43767
           ‾‾‾‾‾‾

|  |  | £ | s. | d. |
|---|---|---|---|---|
| (2)...553 | | | 7 | 8 |

(2)...553    7   8
       20
    ‾‾‾‾‾
    11067
      3
    ‾‾‾‾‾
    33203 fourpenny-pieces

        sq. yds.            cu. in.

(3)...      94259         (4)...1728 $\left\{\begin{array}{l} 12)1353024 \\ 12)112752 \\ 12)9396 \end{array}\right.$

yds.   qrs.    $\left\{\begin{array}{l} 11)377036 \\ 11)34276 \end{array}\right.$
$30\frac{1}{4}=121$

            40)3116

           4)77   36 per.

            19   1 rood

$27 \left\{\begin{array}{l} 3)783 \text{ cu. ft.} \\ 9)261 \end{array}\right.$

         29 cu. yds.

*Ans.* 19 ac. 1 ro. 36 per.

(5)...$72 \left\{\begin{array}{l} 6)2 \quad 0 \quad 6 \\ 12) \quad\;\, 6 \quad 9 \end{array}\right.$ £   s.   d.

                         $6\frac{3}{4}d$. per yd.

        s.   d,

(6)...     19   $7\frac{1}{2}$

        $6 \times 6 \times 10 + 5 = 365$

    5 17   9
    ‾‾‾‾‾‾‾
        6

    35   6   6
    ‾‾‾‾‾‾‾
       10

    353   5   0
     4 18   $1\frac{1}{2}$
    ‾‾‾‾‾‾‾‾‾
   £358   3   $1\frac{1}{2}$

                 ac.   ro.   per.

(7)...$25 \left\{\begin{array}{l} 5)5 \quad 1 \quad 35 \\ 5)1 \quad 0 \quad 15 \end{array}\right.$

                       35 perches

                 £   s.   d.

     450 gui. = 472 10   0

Annual expenditure = 358   3   $1\frac{1}{2}$

   Annual savings = 114   6   $10\frac{1}{2}$

              men   men   days

(8)...         8 : 10 :: 14 : $x$

         $x = \dfrac{10 \times 14}{8} = 17\frac{1}{2}$ days

(9)...
$$\begin{array}{cc} s. & d. \\ \text{Loss on } \pounds 1 = 7 & 3 \end{array}$$

$$\begin{array}{ccccccccc} \pounds & & \pounds & s. & & s. & d. & & \\ 1 & : & 792 & 5 & :: & 7 & 3 & : & x \\ 20 & & 20 & & & 12 & & & \\ \hline \overline{20} & & \overline{15845} & & & \overline{87} & & & \end{array}$$

$$x = \frac{\overset{3169}{\cancel{15845}} \times 87}{\underset{4}{\cancel{20}}} = 68925\tfrac{3}{4} \overset{d.}{=} \pounds 287 \; 3s. \; 9\tfrac{3}{4}d.$$

(10)...
4 daughters, each one share = 4 shares
wife = 3 „
$\overline{7}$ shares

$$\begin{array}{l} \pounds \\ 7)5250 = 5000 \text{ guineas} \\ \hline \pounds 750 \text{ each daughter's portion} \\ \phantom{\pounds 750 } 3 \\ \hline \pounds 2250 \text{ wife's portion} \end{array}$$

## EXERCISE XXII.

(1)...
| ac. | ro. | po. | yds. |
|---|---|---|---|
| 27 | 2 | 15 | 26 |
| 11 | 3 | 28 | 20 |
| 15 | 2 | 27 | 6 |

(2)...
| | | | $\pounds$ | s. | d. |
|---|---|---|---|---|---|
| 59 gui. | = | | 61 | 19 | 0 |
| 43 sov. | = | | 43 | 0 | 0 |
| 65 hf. cr. | = | | 8 | 2 | 6 |
| | | | 113 | 1 | 6 |
| | | | 20 | | |
| | | | 2261 | | |
| | | | 12 | | |
| | | | 27138 pence | | |

(3)...
| wks. | da. | hrs. | min. |
|---|---|---|---|
| 37 | 5 | 19 | 35 |
| 7 | | | |
| 264 | | | |
| 24 | | | |
| 6355 | | | |
| 60 | | | |
| 381335 | | | |
| 60 | | | |
| 22880100 seconds | | | |

(4)...
gal.
2)79596
4)39798
8)9949  2 pks.
qrs. 1243  5 bu. 2 pks.

|  |  | s. | d. | £ | s. | d. |
|---|---|---|---|---|---|---|
| (5)... | 6 lb. black tea | 3 | 10 | = 1 | 3 | 0 |
| | 1½ „ green „ | 4 | 8 | = | 7 | 0 |
| | 8¼ „ coffee | 1 | 8 | = | 13 | 9 |
| | 14 „ lump sugar | | 6½ | = | 7 | 7 |
| | 21 „ moist „ | | 5 | = | 8 | 9 |

£3  0  1

(6)...

$$
\begin{array}{cc}
\text{yds.} & \text{yds.} \\
17\tfrac{1}{2} & 29\tfrac{3}{4} \\
4 & 4 \\
\hline
70 & 119
\end{array}
\quad :: \quad
\begin{array}{ccc}
£ & s. & d. \\
8 & 6 & 3 \\
20 \\
\hline
166 \\
12 \\
\hline
1995
\end{array}
\quad : \quad x
$$

$$
x = \frac{119 \times \overset{57}{\cancel{1995}}}{\underset{2}{\cancel{70}}} = 3391\tfrac{1}{2} \overset{d.}{} = £14 \ 2s. \ 7\tfrac{1}{2}d.
$$

(7)...

|  | £ | s. | d. |
|---|---|---|---|
| cost price | 13 | 19 | 5 |
| required profit | 3 | 3 | 0 |
| selling price | 17 | 2 | 5 |

$$
\begin{array}{cc}
\text{lb. oz.} & \text{lb.} \\
73 \ 6 & 1 \\
16 & 16 \\
\hline
1174 & 16
\end{array}
\quad :: \quad
\begin{array}{ccc}
£ & s. & d. \\
17 & 2 & 5 \\
20 \\
\hline
342 \\
12 \\
\hline
4109
\end{array}
\quad : \quad x
$$

$$
x = \frac{\overset{8}{\cancel{16}} \times \overset{7}{\cancel{4109}}}{\underset{587}{\cancel{1174}}} = 56d. = 4s. \ 8d. \text{ per lb.}
$$

(8)...

$$
\begin{array}{ccc}
\text{ac.} & \text{ro.} & \text{per.} \\
175 & 2 & 20 \\
4 \\
\hline
702 \\
40 \\
\hline
28100
\end{array}
\quad : \quad
\begin{array}{c}
\text{ac.} \\
1 \\
4 \\
\hline
4 \\
40 \\
\hline
160
\end{array}
\quad :: \quad
\begin{array}{ccc}
£ & s. & d. \\
316 & 2 & 6 \\
20 \\
\hline
6322 \\
12 \\
\hline
75870
\end{array}
\quad : \quad x
$$

$$
x = \frac{\overset{8}{\cancel{160}} \times \overset{54}{\cancel{75870}}}{\underset{1405}{\cancel{28100}}} = 432 \overset{d.}{} = £1 \ 16s. \text{ per acre.}
$$

(9)...Perimeter of ground = ($148\frac{1}{2}$ + $101\frac{1}{4}$) × 2 = $499\frac{1}{2}$ yards
　　　　　　　　　　　yds.　　yds.
　　　　　　　　　= 17982 inches

Length of each hurdle 6 ft. 9 in. = 81 inches

17982 ÷ 81 = 222 hurdles

(10)...9 qrs. 5 bu. oats at 22 6 per qr. = 10 16 $6\frac{3}{4}$ B's debt
　　　17 tons 9 cwt. coals at 11 8 per ton = 10　3　7　A's debt
　　　　　　　　　　　　　　　　　B owes A　　12 $11\frac{3}{4}$

*EXERCISE XXIII.*

(1)...

| cwt. | qrs. | lb. |
|---|---|---|
| 19 | 3 | 23 |
| 13 | 1 | 19 |
| 43 | 2 | 15 |
| 16 | 1 | 26 |
| 12 | 0 | 17 |

tons 5　5　2　16

(2)...

```
        3059
         109
       27531
        3059
437)333431(763
    3059
    ────
    2753
    2622
    ────
    1311
    1311
    ────
```

(3)...

219 hf. cr. = 27　7　6
37 hf. gui. = 19　8　6
£ 7 19 0

(4)...

$144\begin{cases} 12)55728 \\ 12)4644 \end{cases}$
　　　　9)387
　　　43 sq. yds.

sq. in.

(5)...

$72\begin{cases} 6)24\ \ 3\ \ 0 \\ 12)4\ \ 0\ \ 20 \end{cases}$
　　　　1 15 per.

ac. ro. per.

(6)...
$$
\begin{array}{ccc}
s. & d. & d. \\
1 & 9 & = 21 \\
\end{array}
$$
$$
\begin{array}{c}
45 \\
\hline
105 \\
\end{array}
$$
$$
\begin{array}{l}
\quad\quad\; d. \; 84 \\
3s. \; 9d. = 45)\overline{945}(21 \text{ lb.} \\
\quad\quad\quad 90 \\
\quad\quad\; \overline{45} \\
\quad\quad\; 45 \\
\quad\quad\; \overline{\phantom{00}}
\end{array}
$$

(7)... $13 + 23 = 36$
$$
\begin{array}{ccccc}
 & & \text{ft.} & \text{in.} & \\
36 \; : \; 13 \; :: \; 25 & 6 \; : \; x
\end{array}
$$
$$
\begin{array}{c}
12 \\
\hline
306
\end{array}
$$
$$
x = \frac{13 \times \overset{17}{\cancel{306}}}{\underset{2}{\cancel{36}}} = 110\tfrac{1}{2} = 9\text{ft. } 2\tfrac{1}{2} \text{ in.}
$$

$$
\begin{array}{lcc}
 & \text{ft.} & \text{in.} \\
\text{whole line} = & 25 & 6 \\
\text{shorter portion} = & 9 & 2\tfrac{1}{2} \\
\text{longer portion} = & 16 & 3\tfrac{1}{2}
\end{array}
$$

(8)...
$$
\begin{array}{lcccc}
 & s. & d. & £ \; s. \; d. \\
6 \text{ lb. at } 4 & 9 & = 1 & 8 \;\; 6 \\
45 \quad,, \quad 3 & 4 & = 7 & 10 \;\; 0 \\
\hline
51 \quad,, \quad = & & 8 & 18 \;\; 6
\end{array}
$$
£8 18 6÷51=3s. 6d. per lb.

(9)...
$$
\begin{array}{lrrr}
 & £ & s. & d. \\
 & 84 & 0 & 0 \\
 & 11 & & \\
\hline
 & 924 & 0 & 0 \\
1 \text{ rood} = & 21 & 0 & 0 \\
20 \text{ per.} = & 10 & 10 & 0 \\
5 \quad,, \quad = & 2 & 12 & 6 \\
2\tfrac{1}{2} \quad,, \quad = & 1 & 6 & 3 \\
\hline
£959 & & 8 & 9
\end{array}
$$

(10)...
$$
\begin{array}{ccc}
\text{yds.} & \text{E. ells} & £ \; s. \; d. \\
15\tfrac{3}{4} \; : \; 47 \; :: \; 2 \; 15 \; 1\tfrac{1}{2} \; : \; x \\
4 \quad\quad 5 \quad\quad 20 \\
\hline
63 \quad 235 \quad\;\; 55 \\
\quad\quad\quad 12 \\
\quad\quad \overline{661} \\
\quad\quad\quad 4 \\
\quad\quad \overline{2646}
\end{array}
$$
$$
x = \frac{235 \times \overset{42}{\cancel{2646}}}{\underset{\cancel{63}}{}} = 9870 = £10 \; 5s. \; 7\tfrac{1}{2}d.
$$

## EXERCISE XXIV.

(1)...£3 12 6¾ = 3483 far.
£105 4 3¾ = 101007 far.
101007 ÷ 3483 = 29 times

(2)...
$$
\begin{array}{lll}
 & & \text{days} \\
\text{Jan. contains} & 31 \\
\text{Feb.} \quad,, & 29 \\
\text{Mar.} \quad,, & 31 \\
\hline
 & 91 \\
 & 24 \\
\hline
 & 364 \\
 & 182 \\
\hline
 & 2184 \\
 & 60 \\
\hline
 & 131040 \text{ min.}
\end{array}
$$

(3)...
$$
\begin{array}{lr}
 & \text{sh.} \\
30 \text{ gal. at } 15s. = & 450 \\
42 \quad,, \quad 18s. = & 756 \\
\hline
72 & 
\end{array}
$$
$$
72 \left\{ \begin{array}{l} 6)\overline{1206} \\ 12)\overline{201} \end{array} \right.
$$
$$
\overline{16s. \; 9d.}
$$

|   |   | s. d. | £ s. d. |
|---|---|---|---|
| (4)... | 12 yds. silk at | 3 6 = | 2 2 0 |
|   | 8 „ flannel at | 1 8 = | 13 4 |
|   | 6 prs. stockings at | 1 9 = | 10 6 |
|   | 3 „ gloves at | 2 6 = | 7 6 |
|   |   |   | £3 13 4 |

$$\begin{array}{ccc} £ & s. & d. \\ 5 & 0 & 0 \\ 3 & 13 & 4 \end{array}$$

change = £1  6  8

da.    da.    £  s.  d.
(5)...365  :  219  ::  7  17  6
        5          3              3
                      5)23 12 6
                      £4 14 6

(6)...        65  per minute
                  60
              3900 per hour
                  24
              15600
              7800
              93600 per day
                  31
              93600
              280800
              2901600

                    yds.
(7)...              126
12s. 6d. =          12½ sh.
                    1512
                      63
    sh. ⎰ 5)1575
    35 ⎱ 7)315
              45 dozen

         £   s.   d.         £    s.        s.
(8)...  5635 17  6   :   3757  5   ::  20   :  *x*
           20               20
        112717           75145
           12               12
        1352610          901740

$$x = \frac{\cancel{901740} \times \overset{s.}{20}}{\underset{3}{\cancel{1352610}}} = \frac{40}{3} = 13s.\ 4d.\ \text{in the } £.$$

(9)...
$$7+9+13 = 29$$

$$\begin{array}{ccc} & £ & s. & d. \\ 29 & : & 7 & :: & 44 & 11 & 9 & : & x \\ & & & & 20 \\ \hline & & & & 891 \\ & & & & 12 \\ \hline & & & & 10701 \end{array}$$

$$x = \frac{7 \times \overset{369}{\cancel{10701}}}{\cancel{29}} = 2583d. = £10 \ 15s. \ 3d.$$

$$\begin{array}{c} d. \\ 29 \quad : \quad 9 \quad :: \quad 10701 \quad : \quad x \end{array}$$

$$x = \frac{9 \times \overset{369}{\cancel{10701}}}{\cancel{29}} = 3321d. = £13 \ 16s. \ 9d.$$

$$\begin{array}{c} d. \\ 29 \quad : \quad 13 \quad :: \quad 10701 \quad : \quad x \end{array}$$

$$x = \frac{13 \times \overset{369}{\cancel{10701}}}{\cancel{29}} = 4797d. = £19 \ 19s. \ 9d.$$

(10)...
$$3\tfrac{1}{2} \text{ miles} = 6160 \text{ yards}$$
$$1 \text{ m. } 6 \text{ fur. } 120 \text{ yds.} = 3200 \text{ yards}$$

$$\begin{array}{ccccc} \text{yds.} & & \text{yds.} & & \text{min.} \\ 6160 & : & 3200 & :: & 60 & : & x \end{array}$$

$$x = \frac{\overset{40}{\cancel{3200}} \times 60}{\underset{77}{\cancel{6160}}} = \overset{\text{min.}}{\frac{2400}{77}} = 31\tfrac{13}{77} \text{ minutes}$$

D

J

*EXERCISE XXV.*

(1)...
$$\begin{array}{ll} & s. \\ 15 \text{ gui.} & = 315 \\ 25 \text{ sov.} & = 500 \\ 30 \text{ hf.-cr.} & = \phantom{0}75 \\ 50 \text{ sh.} & = \phantom{0}50 \\ \hline & \phantom{0}940 \\ & \phantom{00}3 \\ \hline & 2820 \text{ fourp.} \end{array}$$

(2)...
$$\begin{array}{r} 257 \\ 553 \\ \hline 771 \\ 1285 \\ 1285 \end{array}$$

$$79\overline{)142121}(1799$$
$$\begin{array}{r} 79 \\ \hline 631 \\ 553 \\ \hline 782 \\ 711 \\ \hline 711 \\ 711 \end{array}$$

(3)...
$$\begin{array}{l} 2 \text{ oz. } 17 \text{ dwts. } 12 \text{ grs.} = \phantom{0}1380 \text{ grains} \\ 155 \text{ oz. } 5 \text{ dwts.} = 74520 \text{ grains} \\ \\ 74520 \div 1380 = 54 \text{ table spoons} \end{array}$$

(4)...
$$\begin{array}{ccccccccc} \text{qrs.} & \text{lb.} & & \text{lb.} & & \pounds & s. & d. & \\ 2 & 10\tfrac{1}{2} & : & 112 & :: & 1 & 18 & 9\tfrac{1}{2} & : \quad x \\ 28 & & & 2 & & 20 & & & \\ \hline 66 & & & \overline{224} & & \overline{38} & & & \\ 2 & & & & & 12 & & & \\ \hline 133 & & & & & \overline{465} & & & \\ & & & & & 4 & & & \\ & & & & & \overline{1862} & & & \end{array}$$

$$x = \frac{224 \times \overset{14}{\cancel{1862}}}{\cancel{133}} = 3136 \text{ far.} = \pounds 3 \text{ } 5s. \text{ } 4d. \text{ per cwt.}$$

(5)...
$$\begin{array}{ccccccccc} \text{lb.} & & \text{cwt.} & \text{qr.} & \text{lb.} & & \pounds & s. & d. \\ 28 & : & 3 & 1 & 21 & :: & 2 & 0 & 10 \quad : \quad x \\ & & 4 & & & & 20 & & \\ & & \overline{13} & & & & \overline{40} & & \\ & & 28 & & & & 12 & & \\ & & \overline{385} & & & & \overline{490} & & \end{array}$$

$$x = \frac{385 \times \overset{35}{\cancel{490}}}{\underset{2}{\cancel{28}}} = 6737\tfrac{1}{2}d. = \pounds 28 \text{ } 1s. \text{ } 5\tfrac{1}{2}d.$$

(6)... $\qquad$ 28 in. × 117 = 3276 in. = 91 yds. per minute

26 mi. = 26 × 1760 = 45760 yards

91)45760(502$\frac{6}{7}$ min. = 8 hrs. 22$\frac{6}{7}$ min.

$\underline{455}$

$\overline{260}$

$\underline{182}$

$\overline{\frac{78}{91}} = \frac{6}{7}$

(7)...

| in. | in. | yds. | | |
|-----|-----|------|---|---|
| 33 | : 56 | :: 45 | : | $x$ |

$$x = \frac{56 \times \overset{15}{\cancel{45}}}{\underset{11}{\cancel{33}}} = \frac{\overset{\text{yds.}}{840}}{11} = 76\frac{4}{11} \text{ yards}$$

(8)... $\qquad$ 82$\frac{1}{4}$ lb. × 7 = 575$\frac{3}{4}$ lb.

| lb. | lb. | £ s. d. | | |
|-----|-----|---------|---|---|
| 79$\frac{1}{2}$ | : 575$\frac{3}{4}$ | :: 13 18 3 | : | $x$ |
| 4 | 4 | 20 | | |
| $\overline{318}$ | $\overline{2303}$ | $\overline{278}$ | | |
| | | 12 | | |
| | | $\overline{3339}$ | | |

$$x = \frac{2303 \times \overset{21}{\cancel{3339}}}{\underset{2}{\cancel{318}}} = 24181\frac{1}{2}d. = £100 \ 15s. \ 1\frac{1}{2}d.$$

(9)...

361 ac. 25 per.=57785 perches

2 a. 3 r. 15 per.=455 perches

57785÷455=127 portions

(10)...9$\frac{1}{2}$ gui. =

| | £ | s. | d. |
|---|---|----|----|
| | 9 | 19 | 6 |
| | | | 17 |
| | $\overline{169}$ | $\overline{11}$ | $\overline{6}$ |
| Cash | 100 | 0 | 0 |

$66\begin{cases} 6)\overline{69 \ 11 \ 6} \\ 11)\overline{11 \ 11 \ 11} \end{cases}$

value of each sheep £1 1 1

## *EXERCISE XXVI.*

(1)...
$$
\begin{array}{r}
17009053 \\
5040026 \\
\hline
102054318 \\
34018106 \\
68036212 \\
85045265
\end{array}
$$

173794)85726069355378(493262537
$$
\begin{array}{r}
695176 \\
\hline
1620846 \\
1564146 \\
\hline
567009 \\
521382 \\
\hline
456273 \\
347588 \\
\hline
1086855 \\
1042764 \\
\hline
440915 \\
347588 \\
\hline
933273 \\
868970 \\
\hline
643037 \\
521382 \\
\hline
1216558 \\
1216588 \\
\hline
\end{array}
$$

(3)...  1 sov. + 1 hf.-sov. + 1 hf.-cr. + 1 fl. = $\begin{array}{ccc} \pounds & s. & d. \\ 1 & 14 & 6 \end{array}$
= 69 sixp.

$$
\begin{array}{ccc}
\pounds & s. & d. \\
46 & 11 & 6 \\
\hline
20 \\
\hline
931 \\
2 \\
\hline
\end{array}
$$

(2)...  $756 \left\{ \begin{array}{l} 7)\,\dfrac{\pounds \quad s. \quad d.}{5799 \;\; 18 \;\; 9} \\ 9)\,\overline{828 \;\; 11 \;\; 3} \\ 12)\,\overline{92 \;\; 1 \;\; 3} \\ \overline{\pounds 7 \;\; 13 \;\; 5\frac{1}{4}} \end{array} \right.$

69)1863(27 of each
$$
\begin{array}{r}
138 \\
\hline
483 \\
483 \\
\hline
\end{array}
$$

|     | da. hrs. |
| --- | --- |
| **(4)**... | June 18... 0 7 |
| June 19 to July 31...43 0 |
| Aug. 1... 0 9 |
| 43 16 |
| 24 |
| 188 |
| 86 |
| 1048 hours |

$$
\begin{array}{lll}
 & £ & s. & d. \\
\textbf{(5)}... & 2 & 17 & 6 \\
\end{array}
$$

**(5)**...
£ s. d.
2 17 6
$3 \times 9 = 27$
8 12 6
9
77 12 6
2 bu. = 0 14 4½
1 bu. = 0 7 2¼
2 pks. = 0 3 7⅛
£78 17 7⅞

**(6)**...      15 men,   each 2 shares = 30 shares
24 women, each 1 share = 24 ,,
54 ,,

£ s. d.
54 { 6)13 10 0
9)2 5 0
5 0 value of each share

∴ each man will receive 10s., and each woman 5s.

**(7)**...      2 cwt. 3 qrs. 22 lb. = 330 lb.
330 lb. at 6½d. per lb. = £8 18s. 9d.

£ s. d.    £ s. d.    lb.
2 6 8  :  8 18 9  ::  112  :  x
20         20
46         178
12         12
560        2145

$$x = \frac{2145 \times 112}{560} = 429 \text{ lb.} = 3 \text{ cwt. } 3 \text{ qrs. } 9 \text{ lb.}$$

ft. in.    ft.    ft.
**(8)**...    6 2  :  185  ::  5  :  x
12         12
74         2220
30

$$x = \frac{2220 \times 5}{74} = 150 \text{ feet}$$

(9)...                37½ yds. × 15 = 562½ yds.
                      45½ yds. × 13 = 591½ yds.

                                        £    s.   d.
                562½ yds. at 6½d. = 15   4   8¼
                591½ yds. at 7½d. = 18   9   8¼
                                      ─────────────
                                      £33  14   4½

              ac.       ac. ro. per.      bu.
(10)...        7    :    9   3  20   ::   392   :   x
              4         4
            ─────     ─────
             28        39
             40        40
            ─────     ─────
            1120      1580

                       79     7
                     1580 × 392
            x = ─────────────────── = 553 bushels
                       1120
                        56


*EXERCISE XXVII.*


        mi. fur. po. yds. ft.                    sec.
(1)...  29   3  27   3   2      (2)...60)26347289
         8                            ─────────────
       ─────                          60)439121      29 sec.
        235                           ─────────────
         40                           24)7318        41 min.
       ─────                          ─────────────
        9427                           7)304         22 hrs.
          5½                           ─────────────
       ─────                             43          3 da.
        47138          *Ans.* 43 wks. 3 da. 22 hrs. 41 min. 29 sec.
        4713½
       ─────
       51851½                                   ac.  ro.
          3                    (3)...   277   2
       ─────                                         2
       155556½                                ─────────────
         12                     37½×2=75 ⎧ 5)555   0
       ─────                             ⎨ 5)111   0
       1866678 inches                    ⎩ 3)22    0    32
                                         ─────────────
                                         7 a. 1 r. 22 per.

(4)...1¾ in.=7 qr. in.

2 ft. 5¾ in.=119 qr. in.

119÷7=17 volumes

|  | £ | s. | d. | £ | s. | d. |
|---|---|----|----|---|----|----|
| (5)...27 sheep at | 1 | 18 | 6 | =51 | 19 | 6 |
| 13 calves at | 2 | 14 | 6 | =35 | 8 | 6 |
|  |  |  |  | £87 | 8 | 0 |

(6)...

|  | £ | s. | d. |
|---|---|----|----|
|  | 4 | 6 | 8 |
|  |  |  | 7 |
|  | 30 | 6 | 8 |
| 10 dwts. = | 2 | 3 | 4 |
| 5  „  = | 1 | 1 | 8 |
| 2½  „  = | 0 | 10 | 10 |
|  | £34 | 2 | 6 |

(7)...

| yds. |   | yds. |   | £ | s. | d. |   |   |
|------|---|------|---|---|----|----|---|---|
| 7¾ | : | 37½ | :: | 3 | 5 | 10½ | : | x |
| 4 |   | 4 |   | 20 |   |   |   |   |
| 31 |   | 150 |   | 65 |   |   |   |   |
|   |   |   |   | 12 |   |   |   |   |
|   |   |   |   | 790 |   |   |   |   |
|   |   |   |   | 4 |   |   |   |   |
|   |   |   |   | 3162 |   |   |   |   |

$$x = \frac{150 \times \cancel{3162}}{\cancel{31}} = 15300 \text{ far.} = £15 \; 18s. \; 9d.$$

(with 102 written above and cancellation marks)

(8)...The receipts from those paying 1d. per week (the number being double that of the others) amount to half the sum received, i.e. to 7s. 4d. per week ; therefore, if each child paid 2d. per week, the weekly payments would be increased by this sum :—

| s. | d. |
|----|----|
| 14 | 8 |
| 7 | 4 |
| £1 2 | 0 |

(9)...April, May, and June together contain 91 days = 13 weeks.

| £ | s. | d. |
|---|----|----|
| 1 | 7 | 6 |
|  |  | 13 |
| £17 | 17 | 6 |

(10)...      The train travels 80 yards in 5 seconds
                              12
                         $\overline{960}$ yards per minute
                              60
                   $1760\overline{)57600}$(32 mi. 1280 yds.
                         5280
                         $\overline{4800}$
                         3520
                         $\overline{1280}$ yards

### EXERCISE XXVIII.

|  |  |  |  |  | ac. | ro. | per. | yds. |
|---|---|---|---|---|---|---|---|---|
| (2)... |  |  |  |  | 33 | 1 | 34 | 18 |

$$\begin{array}{r} 33 \quad 1 \quad 34 \quad 18 \\ 4 \\ \hline 133 \\ 40 \\ \hline 5354 \\ 30\frac{1}{4} \\ \hline 160638 \\ 1338\frac{1}{2} \\ \hline 161976\frac{1}{2} \\ 9 \\ \hline 1457788\frac{1}{2} \text{ sq. feet} \end{array}$$

|  | £ | s. | d. |
|---|---|---|---|
| (1)... | 25 | 8 | 9 |
| 17½ gui. = | 18 | 7 | 6 |
|  | £6 16 3 | | |

$$\begin{array}{r} 25 \quad 8 \quad 9 \\ 18 \quad 7 \quad 6 \\ \hline £6 \quad 16 \quad 3 \end{array}$$

|  | qrs. | bu. |  | qrs. | bu. | pks. |  | da. |  |  |
|---|---|---|---|---|---|---|---|---|---|---|
| (3)... | 2 | 5 | : | 12 | 3 | 3 | :: | 16 | : | $x$ |
|  | 8 | | | 8 | | | | | | |
|  | $\overline{21}$ | | | $\overline{99}$ | | | | | | |
|  | 4 | | | 4 | | | | | | |
|  | $\overline{84}$ | | | $\overline{399}$ | | | | | | |

$$x = \frac{\overset{19}{\cancel{399}} \times \overset{4}{\cancel{16}}}{\underset{\cancel{4}}{\cancel{84}}} = 76 \text{ days}$$

```
                              s.  d.    £  s.  d.
(4)...    13  yds. Sheeting ...... 1   9 = 1   2   9
          10½  „   Irish Linen ... 2   3 = 1   3   7½
          6¾  „   Flannel......... 1  10 = 0  12   4½
           2  doz. Napkins ......18   6 = 1  17   0
                                        £4  15   9
```

```
            £   s.  d.      5 cwt. 2 qrs. 7 lb. = 623 lb.
(5)...      2   6   8                            6
                    5                      12)3738
                11  13   4                   20)311   6
2 qrs. =    1   3   4        selling price  15  11   6
7 lb.  =    0   2  11        cost price     12  19   7
            £12  19   7      profit         £2  11  11
```

```
           gui.          £        £  s.  d.
(6)...      45   :      85   ::   9  1  1½   :   x
            21          20        90
           945         1700      181
                                  12
                                2173
                                   4
                                8694
```

$$x = \frac{\cancel{1700} \times \cancel{8694}}{\cancel{945}} = 15640 \text{ far.} = £16 \ 5s. \ 10d.$$

```
                                   £    s.
(7)...    17 oxen at £11 15s. =   199  15
          21    „    £13 13s. =   286  13
                                  486   8
```

```
38 oxen at £13 2s. 6d. = £498 15s.
                          £    s.
         selling price   498  15
         cost price      486   8
         profit          £12   7
```

(8)...

| yds. | ft. | in. |
|------|-----|-----|
| 125 | 2 | 0 |
| 114 | 1 | 6 |
| 89 | 2 | 3 |
| 137 | 1 | 9 |
| 467 | 1 | 6 |

$467\ 1\ 6 = 467\frac{1}{2}$ yds.

$467\frac{1}{2}$ yds. at 1s. 6d. = £35 1s. 3d.

(9)...

| hrs. | min. | | hr. | :: | mi. | | |
|------|------|---|-----|----|-----|---|---|
| 6 | 20 | : | 1 | :: | 23 | : | $x$ |
| | 60 | | 60 | | | | |
| | 380 | | 60 | | | | |

$$x = \frac{\overset{3}{\cancel{60}} \times 23}{\underset{19}{\cancel{380}}} = \frac{69}{19} \text{ miles} = 3 \text{ mi. } 5 \text{ fur. } 11\frac{11}{19} \text{ yds.}$$

(10)...    900   +   1250   +   1600 = 3750 men

3750   :   900   ::   75   :   $x$

$$x = \frac{\overset{18}{\cancel{900}} \times \cancel{75}}{\underset{50}{\cancel{3750}}} = 18 \text{ men}$$

3750   :   1250   ::   75   :   $x$

$$x = \frac{\overset{25}{\cancel{1250}} \times \cancel{75}}{\underset{50}{\cancel{3750}}} = 25 \text{ men}$$

3750   :   1600   ::   75   :   $x$

$$x = \frac{\overset{32}{\cancel{1600}} \times \cancel{75}}{\underset{50}{\cancel{3750}}} = 32 \text{ men}$$

## EXERCISE XXIX.

(1)...£19 12s. 9d. = 4713d.
£373  2s. 3d. = 89547d.

89547÷4713 = 19 times

<div style="text-align:right">

mi. fur. po.
(2)...7  5 16
$\frac{8}{61}$
40
$\overline{2456}$
$5\frac{1}{2}$
$\overline{12280}$
1228
$\overline{13508}$ yards

</div>

(3)...
$$\text{sq. yds.}$$
$$67384$$
$$4$$

yds.   qrs.
$30\frac{1}{4}=121$ ⌠ 11)$\overline{269536}$
. 11)$\overline{24503}$ 3 ⎫ 69 qrs.$=17\frac{1}{4}$ yds.
40)$\overline{2227}$ 6 ⎭
4) $\overline{55}$ 27 per.
$\overline{13}$ 3 ro.

*Ans.* 13 ac. 3 ro. 27 per. $17\frac{1}{4}$ yds.

(4)...
hrs.        hrs.        min.
$11\frac{1}{4}$  :  $15\frac{3}{4}$  ::  5  :  $x$
$\frac{4}{45}$        $\frac{4}{63}$

$$x = \frac{\cancel{63} \times \cancel{5}}{\cancel{45}} = 7 \text{ min.}$$

(5)...  3 cwt. 1 qr. 14 lb. × 7 = 23 cwt. 2 qrs. 14 lb.

cwt.        cwt. qrs. lb.        s.  d.
20  :  23  2 14  ::  16  8  :  $x$
$\frac{4}{80}$      $\frac{4}{94}$              $\frac{12}{200}$
$\frac{28}{2240}$      $\frac{28}{2646}$

$$x = \frac{\cancel{2646} \times \cancel{200}}{\cancel{2240}} = \frac{945}{4}d. = 19s.\ 8\frac{1}{4}d.$$

(6)...

$$\begin{array}{r} d. \\ 4\tfrac{1}{2} \\ 4\times 9 = 36 \\ \hline 1\quad 6 \\ 9 \\ \hline 13\quad 6 \text{ per piece} \\ 5\times 5 = 25 \\ \hline 3\quad 7\quad 6 \\ 5 \\ \hline \end{array}$$

s. d.
$$\overline{16\quad 17\quad 6} \text{ selling price}$$
$$12\quad 7\tfrac{1}{2}\times 25 = 15\quad 15\quad 7\tfrac{1}{2} \text{ cost price}$$
$$£1\quad 1\quad 10\tfrac{1}{2} \text{ profit}$$

(7)...

$$\begin{array}{r} po.\quad yds. \\ 25\quad 16 \\ 5\times 9+2 = 47 \\ \hline 3\quad 7\quad 19\tfrac{1}{2} \\ 9 \\ \hline 7\quad 0\quad 28\quad 24\tfrac{1}{2} \\ 1\quad 11\quad 1\tfrac{3}{4} \\ \hline 7 \text{ a. } 1 \text{ r. } 39 \text{ p. } 26 \text{ yds.} \end{array}$$

(8)...

$$\begin{array}{ccccccc} yds. & & E. \text{ ells} & & s. & d. & \\ 19\tfrac{3}{4} & : & 73\tfrac{1}{2} & :: & 16 & 5\tfrac{1}{2} & : \quad x \\ 4 & & 5 & & 12 & & \\ \hline 79 & & 367\tfrac{1}{2} & & 197 & & \\ 2 & & 2 & & 4 & & \\ \hline 158 & & 735 & & 790 & & \end{array}$$

$$x = \frac{735 \times \cancel{790}^{\,5}}{\cancel{158}} = 3675 \text{ far.} = £3\ 16s.\ 6\tfrac{3}{4}d.$$

(9)...

s. d. d.
$$3\quad 8 = 44$$
$$\begin{array}{r} 79\tfrac{3}{4} \\ \hline 396 \\ 308 \\ 33 \\ \hline 3509 \end{array}$$

d. hf. d.
$$5\tfrac{1}{2} = 11)\overline{7018}\ \ 2$$
$$638 \text{ lb.} = 5 \text{ c. } 2 \text{ q. } 22 \text{ lb.}$$

(10)...

$$\begin{array}{rrr} £ & s. & d. \\ \text{each suit } 3 & 6 & 3 \\ \text{each rifle } 5 & 5 & 0 \\ \hline 8 & 11 & 3 \\ & 5\times 5\times 6 = 150 \\ \hline 42 & 16 & 3 \\ & 5 \\ \hline 214 & 1 & 3 \\ & 6 \\ \hline £1284 & 7 & 6 \end{array}$$

## EXERCISE XXX.

(1)...

$$27 \left\{ \begin{array}{l} \begin{array}{rrr} £ & s. & d. \\ 3)20 & 9 & 6 \end{array} = 19\tfrac{1}{2} \text{ gui.} \\ \hline 9)6\quad 16\quad 6 \\ \hline 15\quad 2 \text{ each} \end{array} \right.$$

**(2)**...

$$
\begin{array}{l}
\phantom{1728}\text{cu. in.}\\
1728\left\{\begin{array}{l}
12)\overline{2316845}\\
\phantom{12}12)\overline{193070}\quad 5\\
\phantom{12}12)\overline{16089}\quad 2
\end{array}\right\}1325\text{ cu. in.}\\
\phantom{1728}27\left\{\begin{array}{l}
\phantom{12}3)\overline{1340}\quad 9\\
\phantom{12}9)\overline{446}\quad 2\\
\phantom{1212}49\quad 5
\end{array}\right\}17\text{ cu. ft.}
\end{array}
$$

*Ans.* 49 cu. yds. 17 cu. ft. 1325 cu. in.

**(3)**...

| | | | | | *s.* | *d.* | £ | *s.* | *d.* |
|---|---|---|---|---|---|---|---|---|---|
| $4\frac{1}{2}$ | lb. | Tea | ............... | 4 | 3 | = 0 | 19 | $1\frac{1}{2}$ |
| 8 | ,, | Coffee | ............ | 1 | 8 | = 0 | 13 | 4 |
| $2\frac{1}{2}$ | ,, | Chocolate | ...... | 2 | 6 | = 0 | 6 | 3 |
| 14 | ,, | Lump Sugar | ...0 | $6\frac{1}{2}$ | = 0 | 7 | 7 |
| 25 | ,, | Moist ,, | ...0 | $5\frac{1}{2}$ | = 0 | 11 | $5\frac{1}{2}$ |
| 8 | ,, | Currants | ......0 | 6 | = 0 | 4 | 0 |
| 6 | ,, | Raisins | .........0 | 7 | = 0 | 3 | 6 |

£3  5  3

**(4)**...

| £ | *s.* | *d.* |
|---|---|---|
| 83 | 7 | 6 |
| 70 | 12 | 6 |
| 12 | 15 | 0 profit on each share |

$6 \times 6 = 36$

| 76 | 10 | 0 |
|---|---|---|
| | 6 | |
| £459 | 0 | 0 |

**(5)**...

| qrs. | lb. | lb. |
|---|---|---|
| 2 | $24\frac{1}{2}$ | = $80\frac{1}{3}$ |
| | | 11 |
| | | $885\frac{1}{3}$ |
| | | $8\frac{1}{4}$ |
| | | 7084 |
| | | $442\frac{3}{4}$ |

12)$\overline{7526\frac{3}{4}}$
20)$\overline{627\quad 2\frac{3}{4}}$
£31  7*s.*  $2\frac{3}{4}d$.

**(6)**...

$$
\begin{array}{ccccc}
s. & d. & & £ & s. & d. & & £\\
3 & 7\frac{1}{2} & : & 11 & 15 & 7\frac{1}{2} & :: & 1 & : & x
\end{array}
$$

| 12 | 20 |
|---|---|
| 43 | 235 |
| 4 | 12 |
| 174 | 2827 |
| | 4 |
| | 11310 |

$$x = \frac{11310}{174} = £65$$

(7)...

$$
\begin{array}{rrr}
£ & s. & d. \\
1 & 18 & 6 \\
\end{array}
$$

$5 \times 10 + 3 = 53$

$$
\begin{array}{rrr}
9 & 12 & 6 \\
 & & 10 \\
\hline
96 & 5 & 0 \\
5 & 15 & 6 \\
\end{array}
$$

7)102   0   6 value of 53 sheep

£14  11   6 value of each ox

(8)...

$$
\begin{array}{cc}
s. & d. \\
12 & 10\frac{1}{2} \\
12 & \\
\hline
154 & \\
4 & \\
\hline
618 & \\
\end{array}
\quad : \quad
\begin{array}{rrr}
£ & s. & d. \\
1774 & 3 & 6 \\
20 & & \\
\hline
35483 & & \\
12 & & \\
\hline
425802 & & \\
4 & & \\
\hline
1703208 & & \\
\end{array}
\quad :: \quad
\begin{array}{c}
£ \\
1 \\
\end{array}
\quad : \quad x
$$

$$ x = \frac{1703208}{618} = £2756 $$

(9)...

$$
\begin{array}{llcrrr}
 & & s. & d. & £ & s. & d. \\
75\frac{1}{2} \text{ lb. Black Tea} & ...3 & 2 & = & 11 & 19 & 1 \\
10\frac{1}{2} \text{ ,, } \text{ Green ,, } & ...3 & 10 & = & 2 & 0 & 3 \\
\end{array}
$$

86

13  19   4

$$
\begin{array}{lrrrrr}
 & s. & d. & £ & s. & d. \\
86 \text{ lb. Mixed Tea} ...3 & 9 & = & 16 & 2 & 6 \\
 & & \text{cost} & 13 & 19 & 4 \\
 & & \text{profit} & £2 & 3 & 2 \\
\end{array}
$$

(10)...35 men, at   2  9 per day each = 4 16  3

15 women, at 1  6    ,,        ,,    = 1  2  6

25 boys, at  1  2    ,,        ,,    = 1  9  2

7   7  11 per day

6

£44   7   6 per week

*EXERCISE XXXI.*

|  |  |  | grs. |
|---|---|---|---|
| Sulphate of iron | . | . | $\frac{1}{2}$ dr. = | 30 |
| Subcarbonate of potash | . |  | = | 10 |
| Myrrh | . . . | . | 1 dr. = | 60 |
| Compound powder of aloes | $\frac{1}{2}$ dr. = | 30 |

30)130

weight of each pill =   4$\frac{1}{3}$ grains

| cwt. | qrs. | lb. | oz. |
|---|---|---|---|
| (2)... 19 | 3 | 23 | 11 |

4

79

28

655

158

2235

16

13421

2235

35771 ounces

(3)...10 ft. 9 in. =   129 in.

4 ft. 3 in. =   51

129

645

6579 sq. inches

(4)...   min.

60)473760

24)7896

7)329

47 weeks

(5)...

$$36 \begin{cases} 6)17 \;\; 3 \text{ s. d.} \\ 6) \;\; 2 \;\; 10\frac{1}{2} \end{cases}$$

5$\frac{3}{4}$ per yard

6)...

| | | s. | d. | £ | s. | d. |
|---|---|---|---|---|---|---|
| 26 yds. Irish linen at | 2 | 3 | = 2 | 18 | 6 |
| 24 „ Calico at | | 7$\frac{1}{2}$ | = | 15 | 0 |
| 12 „ Sheeting at | 1 | 10$\frac{1}{2}$ | = 1 | 2 | 6 |
| 18 „ Flannel at | 1 | 9 | = 1 | 11 | 6 |
| 6 prs. Stockings at | 2 | 3 | = | 13 | 6 |
| 3 „ Gloves at | 1 | 9 | = | 5 | 3 |

£7   6   3

(7)...  1 cwt. 1 qr. 7 lb.  × 15 = 19 cwt. 2 qrs. 21 lb.

$$
\begin{array}{rrr}
\pounds & s. & d. \\
2 & 11 & 4 \\
\end{array}
$$

$$3 \times 6 + 1 = 19$$

$$
\begin{array}{rrr}
7 & 14 & 0 \\
 & & 6 \\
\hline
46 & 4 & 0 \\
2 & 11 & 4 \\
\end{array}
$$

$$
\begin{array}{rrrr}
2 \text{ qrs.} = & 1 & 5 & 8 \\
14 \text{ lb.} = & & 6 & 5 \\
7 \text{ lb.} = & & 3 & 2\tfrac{1}{2} \\
\hline
\pounds 50 & 10 & 7\tfrac{1}{2} \\
\end{array}
$$

(8)...16d. per gal.=2d. per pint

1½ pint × 365 = 547½ pints

$$
\begin{array}{l}
\phantom{00}2 \\
12)\overline{1095} \\
\phantom{0}20)\overline{91\ 3} \\
\hline
\phantom{00}\pounds 4\ 11s.\ 3d.
\end{array}
$$

(9)...45 lb. at 14½=

$$
\begin{array}{rrr}
d. & \pounds & s. & d. \\
\end{array}
$$

$$
\begin{array}{lrrr}
45 \text{ lb. at } 14\tfrac{1}{2} = & 2 & 14 & 4\tfrac{1}{2} \\
10 \text{ lb. at } 4\tfrac{1}{2} = & & 3 & 9 \\
\hline
55 & & 2 & 18 & 1\tfrac{1}{2} \\
\end{array}
$$

$$
\begin{array}{lrrr}
 & \pounds & s. & d. \\
55 \text{ lb. at } 16d. = & 3 & 13 & 4 \\
\text{cost} = & 2 & 18 & 1\tfrac{1}{2} \\
\hline
\text{profit} = & & 15 & 2\tfrac{1}{2} \\
\end{array}
$$

(10)...

$$
\begin{array}{l}
\phantom{00}30000 \\
\phantom{00000}2 \\
24 \left\{ \begin{array}{l} 4)\overline{60000} \text{ gallons required daily} \\ 6)\overline{15000} \end{array} \right. \\
\hline
\phantom{0}2500 \text{ gallons per hour}
\end{array}
$$

## EXERCISE XXXII.

(1)...

hf. cr.

$$
\begin{array}{l}
\phantom{000}76 \\
\phantom{000}30 \\
1 \text{ fl.} = 24 \left\{ \begin{array}{l} 4)\overline{2280} \\ 6)\overline{570} \end{array} \right. \\
\hline
\phantom{00}95 \text{ florins}
\end{array}
$$

(2)...  19¾ gui. = 4977d.

£2633 13s. 3d. = 632079d.

632079 ÷ 4977 = 127 times

(3)...
$$\begin{array}{r} \text{lb.} \\ 175 \\ 17 \\ \hline 1225 \\ 175 \\ \hline 2975 \text{ lb.} \\ 2\frac{3}{4} \\ \hline 5950 \\ 1487\frac{1}{2} \\ 743\frac{3}{4} \\ \hline 12)8181\frac{1}{4} \\ \hline 20)681 \; 9\frac{1}{4} \\ \hline \text{£34 1 } 9\frac{1}{4} \end{array}$$

(4)...1 lb. troy = 5760 grains
$$\begin{array}{r} 55 \\ \hline 28800 \\ 28800 \\ \hline 7000)316800(45\frac{9}{35} \text{ lb. Av.} \\ 28000 \\ \hline 36800 \\ 35000 \\ \hline 1800 \\ \hline 7000 \end{array} = \tfrac{9}{35}$$

(5)...   $9+10+11 = 30$
$£885 \div 30 = £29 \; 10s.$

$£29 \; 10s. \times \; 9 = £265 \; 10s.$
$£29 \; 10s. \times 10 = £295$
$£29 \; 10s. \times 11 = £324 \; 10s.$

(6)...1 qt., 1 pt., and $\frac{1}{2}$ pt.=7 hf. pts.
$52\frac{1}{2}$ gallons=840 hf. pts.

$$\begin{array}{r} 7)840 \\ \hline 12)120 \text{ of each size} \\ \hline 10 \text{ dozen of each} \end{array}$$

(7)...
| | $s.$ | $d.$ | | gui. | | E. ell | |
|---|---|---|---|---|---|---|---|
| | 5 | $7\frac{1}{2}$ | : | $27\frac{1}{2}$ | :: | 1 | : $x$ |
| | 12 | | | 21 | | 5 | |
| | $\overline{67}$ | | | $\overline{577\frac{1}{2}}$ | | $\overline{5}$ | |
| | 4 | | | 12 | | | |
| | $\overline{270}$ | | | $\overline{6930}$ | | | |
| | | | | 4 | | | |
| | | | | $\overline{27720}$ | | | |

$$x = \frac{\overset{308}{\cancel{27720}} \times 5}{\underset{3}{\cancel{270}}} = \frac{1540}{3} \text{ qrs. } \tfrac{1}{3} = 513\frac{1}{3} \text{ qrs. } = 128 \text{ yds.}$$

(8)
| | ti. | | ti. | | ti. | | |
|---|---|---|---|---|---|---|---|
| | 13 | : | 9 | :: | 221 | : | $x$ |

$$x = \frac{9 \times \overset{17}{\cancel{221}}}{\cancel{13}} = 153 \text{ times}$$

E

(9)...

| hrs. min. | | hr. | | mi. | yds. | | |
|---|---|---|---|---|---|---|---|
| 7    6 | : | 1 | :: | 26 | 1100 | : | $x$ |
| 60 | | 60 | | 1760 | | | |
| $\overline{426}$ | | $\overline{60}$ | | $\overline{2660}$ | | | |
| | | | | 182 | | | |
| | | | | 26 | | | |
| | | | | $\overline{46860}$ | | | |

$$x = \frac{60 \times \cancel{46860}^{110}}{\cancel{426}} = 6600 \text{ yds.} = 3\tfrac{3}{4} \text{ miles}$$

(10)...
$$3 \text{ qrs. } 10\tfrac{1}{2} \text{ lb.} \times 300 = 28350 \text{ lb.}$$

| lb. | | lb. | | s. | | |
|---|---|---|---|---|---|---|
| 112 | : | 28350 | :: | 63 | : | $x$ |

$$x = \frac{\cancel{28350}^{2025} \times 63}{\underset{8}{\cancel{112}}} = \frac{127575}{8} \text{ sh.} = \pounds 797 \; 6s. \; 10\tfrac{1}{2}d.$$

*EXERCISE XXXIII.*

(1)...

$$\begin{array}{rrr} \pounds & s. & d. \\ 82 & 6 & 10\tfrac{1}{2} \\ & & 4 \end{array}$$

7¾ × 4 = 31)329   7   6 (£10 12s. 6d.
          310
          $\overline{19}$
          20
      31)387(12s.
          372
          $\overline{15}$
          12
      31)$\overline{186}$(6d.
          186

(2)...

$$\begin{array}{rrr} ac. & ro. & po. \\ 137 & 2 & 37 \\ 4 & & \end{array}$$

          550
          40
        $\overline{22037}$
          30¼
        $\overline{661110}$
          5509¼
        $\overline{666619}$¼ sq. yds.

(3)

| yds. | qrs. | na. | | yd. | | £ | s. | d. | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 39 | 2 | 3 | : | 1 | :: | 23 | 3 | 0¼ | : | $x$ |
| 4 | | | | 4 | | 20 | | | | |
| 158 | | | | 4 | | 463 | | | | |
| 4 | | | | 4 | | 12 | | | | |
| 635 | | | | 16 | | 5556 | | | | |
| | | | | | | 4 | | | | |
| | | | | | | 22225 | | | | |

$$x = \frac{16 \times \overset{35}{\cancel{22225}}}{\cancel{635}} = 560 \text{ far.} = 11s. \ 8d. \text{ per yard}$$

(4)...

| £ | s. | d. | | £ | s. | d. | | t. | cwt. | qrs. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 11 | 8 | : | 1 | 15 | 10 | :: | 2 | 7 | 2 | : | $x$ |
| 20 | | | | 20 | | | | 20 | | | | |
| 31 | | | | 35 | | | | 47 | | | | |
| 12 | | | | 12 | | | | 4 | | | | |
| 380 | | | | 430 | | | | 190 | | | | |

$$x = \frac{\overset{215}{\cancel{430} \times \cancel{190}}}{\underset{2}{\cancel{380}}} = 215 \text{ qrs.} = 2 \text{ tons } 13 \text{ cwt. } 3 \text{ qrs.}$$

(5)...

|  |  | s. | d. |
|---|---|---|---|
| 1 ell at 10s. 6d. per yard = | | 13 | 1½ |
| | | 11 | 3 |
| profit on 1 ell = | | 1 | 10½ |
| | 8 × 7 = 56 | | |
| | | 15 | 0 |
| | | | 7 |
| | £5 | 5 | 0 |

(6)...

2 ft. 8 in. × 750 = 2000 feet
            12
3)24000 ft. per hour
1760)8000(4 mi. 960 yds.
     7040
     ‾‾‾‾
      960 yds.

R 2

(7)...  388 sq. yds. 18 sq. in. = 502866 sq. in.
     25 yds. 1 ft. 9 in. = 921 in.     )

     sq. in.  in.  in. yds. ft. in.
     502866÷921 = 546 = 15  0  6

(8)...The extra time is one-seventh of the regular day's work, and, at the ordinary rate of payment, would be 8$d$. additional per day : hence—

$$
\begin{array}{r}
d. \\
8 \\
2 \\
\hline
1 \quad 4 \\
6 \\
\hline
\end{array}
$$

    extra wages = $\overline{8s. \ \ 0}d.$ per week

(9)...
   ac.   ac. ro. po.  £ $s.$ $d.$
   1  :  353 2  20  ::  1 12  6  :  $x$
   4    4      20
   $\overline{4}$  $\overline{1414}$    $\overline{32}$
   40   40     12
   $\overline{160}$  $\overline{56580}$    $\overline{390}$

$$
x = \frac{\cancel{56580} \times \cancel{390}}{\cancel{160}} = \frac{551655}{4}d. = \text{£}574\ 12s.\ 9\tfrac{3}{4}d.
$$

(with the cancellation marks: 2829, 195, 8, 4)

(10)...Dividends $7\ \overset{s.}{}6 + 2\ \overset{d.}{}9 + 1\ \overset{s.\ d.}{}6 = 4\tfrac{1}{2} = 12\ 1\tfrac{1}{2}$ in the pound

   £   £   $s.$ $d.$
   1 :  3575 ::  12 1$\tfrac{1}{2}$ : $x$
           12
         $\overline{145}$
          4
         $\overline{582}$

$x = 3575 \times 582 = 2080650$ far. $= \text{£}2167\ 6s.\ 10\tfrac{1}{2}d.$

## EXERCISE XXXIV.

(1)...
$$
\begin{array}{r}
200006 \\
20019 \\
\hline 179987
\end{array}
$$

(2)...
$$
\begin{array}{r}
9291 \\
267 \\
\hline 65037 \\
55746 \\
18582 \\
\end{array}
$$

$$489)\overline{2480697}(5073$$
$$
\begin{array}{r}
2445 \\
\hline 3569 \\
3423 \\
\hline 1467 \\
1467 \\
\hline
\end{array}
$$

(3)...
$$
\begin{array}{r}
\text{yds.} \\
146\tfrac{1}{4} \\
4 \\
\hline
\end{array}
$$
$$5)\overline{585}$$
$$\overline{117 \text{ E. ells}}$$

(4)...
$$
\begin{array}{cccc}
\text{mi.} & \text{fur.} & \text{per.} & \text{yds.} \\
19 & 5 & 19 & 2\tfrac{1}{2}
\end{array}
$$
$$
\begin{array}{r}
8 \\
\hline 157 \\
40 \\
\hline 6299 \\
5\tfrac{1}{2} \\
\hline 31497\tfrac{1}{2} \\
3149\tfrac{1}{2} \\
34647 \\
3 \\
\hline 103941 \\
12 \\
\hline 1247292 \text{ inches}
\end{array}
$$

(5)...
$$36 \left\{
\begin{array}{c}
\text{£} \quad s. \quad d. \\
6)\overline{3 \quad 3 \quad 0} \\
6)\overline{\quad 10 \quad 6} \\
4)\overline{\quad 1 \quad 9} \text{ per gal.} \\
5\tfrac{1}{4}d. \text{ per qt.}
\end{array}
\right.$$

(6)...
$$
\begin{array}{r}
s. \quad d. \quad d. \\
4 \quad 3 = 51 \\
53 \\
\hline 153
\end{array}
$$
$$
\begin{array}{l}
s. \quad d. \quad d. \; 255 \\
3 \quad 9 = 45)\overline{2703}(60\tfrac{1}{15} \text{ yds.} \\
\quad\quad\quad 270 \\
\quad\quad\quad \overline{\quad 3} = \tfrac{1}{15} \\
\quad\quad\quad 45
\end{array}
$$

(7)...
$$
\begin{array}{ccc}
\text{da.} & \text{da.} & \text{hrs.} \\
8\tfrac{3}{4} & : \; 10\tfrac{1}{2} :: \; 7\tfrac{1}{2} & : \; x \\
4 & 4 & 4 \\
\hline 35 & 42 & 30
\end{array}
$$
$$x = \frac{\overset{6}{\cancel{42}} \times \overset{6}{\cancel{30}}}{\underset{5}{\cancel{35}}} = 36 \text{ qrs.} = 9 \text{ hrs.}$$

|  | da. hrs. |
|---|---|
| (8)... May 13... | 0 18 |
| May 14 to July 10...58 | 0 |
| July 11... | 0 18 |
| | $\overline{59\ 12}$ |
| | 24 |
| | $\overline{248}$ |
| | 118 |
| | $\overline{1428}$ hrs. |

11067÷1428=7¾ miles per hr.

|  | cwt. qrs. lb. |
|---|---|
| (9)... | 3 2 10 |
| | 7 |
| | $\overline{25\ \ 0\ 14}$ |

|  | s. d. |
|---|---|
| 112 lb. at 5½d. | =51 4 |
| cost per cwt. | =45 0 |
| profit on 1 cwt. | = 6 4 |
| | 5×5=25 |
| | $\overline{1\ 11\ 8}$ |
| | 5 |
| | $\overline{7\ 18\ 4}$ |
| 14 lb. = | 9½ |
| | $\overline{£7\ 19\ 1½}$ |

|  | t. cwt. qr. |
|---|---|
| (10)... weight of loaded truck = | 4 1 1 |
| weight of truck = | 1 5 0 |
| weight of parcels = | $\overline{2\ 16\ \ 1}$ |

2 tons 16 cwt. 1 qr. = 6300 lb.

6300÷360 = 17½ lb.

## EXERCISE XXXV.

|  | £ s. d. |
|---|---|
| (1)...17 hf. gui. = | 8 18 6 |
| 17 hf. sov. = | 8 10 0 |
| 17 hf. cr. = | 2 2 6 |
| 17 sixp. = | 0 8 6 |
| 17 hf. pence = | 0 0 8½ |
| | $\overline{20\ \ 0\ \ 2½}$ |
| | 20 |
| | $\overline{400}$ |
| | 12 |
| | $\overline{4802}$ |
| | 4 |
| | $\overline{19210}$ far. |

|  | wks. da. hrs. min. |
|---|---|
| (2)... | 43 4 20 43 |
| | 7 |
| | $\overline{305}$ |
| | 24 |
| | $\overline{1240}$ |
| | 610 |
| | $\overline{7340}$ |
| | 60 |
| | $\overline{440443}$ |
| | 60 |
| | $\overline{26426580}$ seconds |

(3)...
$$
\begin{array}{r}
\text{da.} \quad \text{hrs.} \\
1 \text{ year} = 365 \quad 6 \\
13 \\
\hline
4748 \quad 6 \\
176 \quad 0 \\
\hline
4924 \quad 6 \\
24 \\
\hline
19702 \\
9848 \\
\hline
118182 \\
60 \\
\hline
7090920 \text{ minutes}
\end{array}
$$

(4)...£296 19 8¾=285107 far.
£9 11 7¼=9197 far.

285107÷9197 = 31

(5)...269 mi. 9 po.=86089 po.
11 mi. 5 fur. 23 po.=3743 po.

86089÷3743 = 23

(6)... 14 : 164 :: 273 : $x$

$$x = \frac{\overset{82}{\cancel{164}} \times \overset{39}{\cancel{273}}}{\cancel{\underset{7}{14}}} = 3198$$

(7)... The money must be divided into 5 parts—

$$
\begin{array}{r}
£ \quad s. \quad d. \\
5)13 \quad 2 \quad 6 \\
\hline
2 \quad 12 \quad 6 \text{ each smaller} \\
3 \quad [\text{portion} \\
\hline
£7 \quad 17 \quad 6 \text{ larger portion}
\end{array}
$$

(8)...
$$
\begin{array}{r}
d. \\
15 \\
56 \\
\hline
90 \\
75 \\
\end{array}
$$

s. d. d.
4 8=56)840(15 lb. of tea
$$
\begin{array}{r}
56 \\
\hline
280 \\
280 \\
\hline
\end{array}
$$

(9)...
| | | | | s. | d. | £ | s. | d. |
|---|---|---|---|---|---|---|---|---|
| 17 yds. | Silk | at | 4 | 6 | =3 | 16 | 6 | |
| 25 „ | Linen | „ | 1 | 7½ | =2 | 0 | 7½ | |
| 14½ „ | Flannel | „ | 1 | 6 | =1 | 1 | 9 | |
| 35 „ | Calico | „ | 0 | 4½ | =0 | 13 | 1½ | |

£7 12 0

(10)...
s. d. s. d. s. d. s. d.
Dividends 3 7½ + 2 6 + 1 8½ = 7 10 in the £
Loss = 20s.—7s. 10d. = 12s. 2d. in the £

$$
\begin{array}{ccccccc}
£ & & £ & s. & d. & s. & d. \\
1 & : & 527 & 12 & 6 & :: & 12 & 2 & : & x \\
8 & & 8 & & & & 12 \\
\hline
8 \text{ hf. cr.} & & 4221 \text{ hf. cr.} & & & & 146
\end{array}
$$

$$x = \frac{4221 \times \overset{73}{\cancel{146}}}{\underset{4}{\cancel{8}}} = \frac{308133}{4}d. = £320 \ 19s. \ 5¼d.$$

## EXERCISE XXXVI.

(1)...

$$5876425$$
$$478$$
$$6039)\overline{5875947}(973$$
$$54351$$
$$\overline{44084}$$
$$42273$$
$$\overline{18117}$$
$$18117$$

(2)...

| | | da. | hrs. |
|---|---|---|---|
| Sept. | 1863 | 1 | 3 |
| Oct. | „ | 31 | 0 |
| Nov. | „ | 30 | 0 |
| Dec. | „ | 31 | 0 |
| Jan. | 1864 | 31 | 0 |
| Feb. | „ | 29 | 0 |
| Mar. | „ | 24 | 10 |

$$\overline{177 \ 13}$$
$$24$$
$$\overline{4261} \text{ hours}$$

(3)...

$$17\tfrac{1}{2} \text{ miles} = 30800 \text{ yds.}$$
$$30800 \text{ yds.} \times 27\tfrac{1}{2} \text{ yds.} = 847000 \text{ sq. yds.}$$
$$847000 \div 4840 = 175 \text{ acres}$$

(5)...1 yd. Matting = 3 ft. $\times$ 2$\tfrac{1}{2}$ ft.
$$= 7\tfrac{1}{2} \text{ sq. ft.}$$

(4)...240 oranges at   8 for 6d. = $\overset{s.}{15}$
    240    „     12 for 6d. = 10
$$\overline{480} \qquad\qquad\qquad \overline{25}$$

$$\overset{\text{ft.}}{66}$$
$$30$$
$$\overline{1980} \text{ sq. ft.}$$
$$2$$

480 oranges at 16 for 1s. = $\overset{s.}{30}$
         cost 25
        profit $\overline{5s.}$

$$7\tfrac{1}{2} \times 2 = 15)\overline{3960}$$
$$\overline{264} \text{ yds.}$$

(6)...    4 cwt. 3 qrs. 17$\tfrac{1}{2}$ lb. $\times$ 7 = 34 cwt. 1 qr. 10$\tfrac{1}{2}$ lb.

| lb. | | cwt. qr. lb. | | £ s. | |
|---|---|---|---|---|---|
| 112 | : | 34 1 10½ | :: | 2 2 | ⦂   $x$ |
| 2 | | 4 | | 20 | |
| $\overline{224}$ | | $\overline{137}$ | | $\overline{42}$ | |
| | | 28 | | | |
| | | $\overline{3846}$ | | | |
| | | 2 | | | |
| | | $\overline{7693}$ | | | |

$$x = \frac{7693 \times \cancel{42}}{\underset{16}{\cancel{224}}} = \frac{23079}{16} s. = £72 \ 2s. \ 5\tfrac{1}{4}d.$$

(7)...

| | £ | s. | d. |
|---|---|---|---|
| | 13 | 16 | 8 |
| | | | 6 |
| | 83 | 0 | 0 |
| 2 roods = | 6 | 18 | 4 |
| 20 poles = | 1 | 14 | 7 |
| 5 poles = | 0 | 8 | 7¾ |
| | £92 | 1 | 6¼ |

(8)...

$$3\tfrac{3}{4} \; : \; 35\tfrac{1}{4} \; :: \; 1 \; : \; x$$

| min. | min. | hrs. |
|---|---|---|
| 3¾ | 35¼ | 1 |
| 4 | 4 | |
| 15 | 141 | |

47

$$x = \frac{\cancel{141}^{47}}{\cancel{15}_{5}} = \frac{47}{5} \text{ hrs.} = 9 \text{ hrs. } 24 \text{ min.}$$

(9)...

| E. ells | | yds. | | £ | s. | d. | | |
|---|---|---|---|---|---|---|---|---|
| 37 | : | 42¾ | :: | 6 | 18 | 9 | : | x |
| 5 | | 4 | | 20 | | | | |
| 185 | | 171 | | 138 | | | | |
| | | | | 12 | | | | |
| | | | | 1665 | | | | |

$$x = \frac{171 \times \cancel{1665}^{9}}{\cancel{185}} = 1539d. = \text{£}6 \text{ } 8s. \text{ } 3d.$$

(10)...

$$7 + 13 + 17 + 19 = 56$$

$$56 \begin{cases} 7)\overline{577 \quad 10 \quad 0} = 550 \text{ guineas} \\ 8)\overline{82 \quad 10 \quad 0} \\ \overline{\text{£}10 \quad 6 \quad 3} \end{cases}$$

| £ | s. | d. |
|---|---|---|

£10 6s. 3d. × 7 = £72 3s. 9d.

£10 6s. 3d. × 13 = £134 1s. 3d.

£10 6s. 3d. × 17 = £175 6s. 3d.

£10 6s. 3d. × 19 = £195 18s. 9d.

## EXERCISE XXXVII.

```
         mi. fur. per. yds.
(1)...    17   7  25   3½
           8                      Proof.
         ───                       in.
         143               12)1137636
          40               ────────────
        ─────               3) 94803
         5745               ──────────
            5½                  31601
        ───────                     2
        28728½           5½×2=11)63202
         2872½                ─────────
        ───────            40)5745   7 hf. yds.=3½ yds.
         31601             ────────
            3               8)143    25 per.
        ───────            ────────
         94803                17     7 fur.
           12
        ─────────          17 mi. 7 fur. 25 per. 3½ yds.
        1137636 inches
```

```
(2)...                    937
                          716
                        ──────
                         5622
                          937
                         6559
                    179)670892(3748
                         537
                        ──────
                         1338
                         1253
                        ──────
                          859
                          716
                        ──────
                         1432
                         1432
                        ──────
```

```
        s. d.  d.      (4)...2 cwt. 3 qrs. 24 lb.=332 lb.
(3)...   4  6=54                        4½d.
            75                        ──────
           ───                         1328
           270                          166
 s. d.   d. 378                     12)1494
37  6=450)4050(9 dozen              20)124   6
           4050                     ──────────
          ─────                     £6  4s.  6d.
```

(5)...
$$\overset{\pounds}{12560} \quad : \quad \overset{\pounds}{1} \quad :: \quad \overset{\pounds \quad s.}{706 \ 10} \quad : \quad x$$
$$\frac{20}{14130}$$

$$x = \frac{\cancel{14130}^{\,9}}{\cancel{12560}_{\,8}} = \frac{9}{8}s. = 1s. \ 1\tfrac{1}{2}d. \text{ in the pound}$$

(6)...
$$1 \text{ mile} = 1760 \text{ yards}$$
$$\frac{27}{12320}$$
$$3520$$
$$\overline{47520}$$
$$2\tfrac{1}{2} \text{ gui.} = \quad \frac{52\tfrac{1}{2}s.}{95040}$$
$$237600$$
$$23760$$
$$20)\overline{2494800}$$
$$\overline{\pounds124740}$$

(7)...
$$\overset{\text{lb.}}{112} \quad : \quad \overset{\text{lb.}}{63\tfrac{1}{2}} \quad :: \quad \overset{\pounds \quad s.}{4 \ 18} \quad : \quad x$$
$$\overset{2}{\underset{224}{\rule{0pt}{0pt}}} \qquad \overset{2}{\underset{127}{\rule{0pt}{0pt}}} \qquad \overset{20}{\underset{98}{\rule{0pt}{0pt}}}$$

$$x = \frac{127 \times \cancel{98}^{\,7}}{\cancel{224}_{\,16}} = \frac{889}{16}s. = \pounds2 \ 15s. \ 6\tfrac{3}{4}d.$$

(8)...
$$11 + 13 = 24$$
$$24 \quad : \quad 11 \quad :: \quad 1752 \quad : \quad x$$
$$x = \frac{11 \times \cancel{1752}^{\,73}}{\cancel{24}} = 803$$
$$1752 - 803 = 949$$

(9)...$32\tfrac{1}{2}$ yds. = 26 E. ells

| | $\pounds$ | $s.$ | $d.$ |
|---|---|---|---|
| 26 ells at 10$s.$ = | 13 | 0 | 0 |
| cost = | 10 | 16 | 8 |
| profit | $\pounds2$ | 3 | 4 |

|  |  |  | s. | d. | £ | s. | d. |
|---|---|---|---|---|---|---|---|
| (10)... | 3 doz. | Port .........44 | 0 | = | 6 | 12 | 0 |
|  | 6 „ | Sherry ......36 | 0 | = | 10 | 16 | 0 |
|  | 2 „ | Marsala......31 | 6 | = | 3 | 3 | 0 |
|  | 4 „ | Madeira ...54 | 0 | = | 10 | 16 | 0 |
|  | 3 „ | Champagne 78 | 0 | = | 11 | 14 | 0 |
|  | 4 „ | Claret ......66 | 0 | = | 13 | 4 | 0 |
|  |  |  |  |  | £56 | 5 | 0 |

## EXERCISE XXXVIII.

(1)...
cu. yds. cu. ft.
19   13
27
‾‾‾‾
146
38
‾‾‾‾
526
1728
‾‾‾‾
4208
1052
3682
526
‾‾‾‾
908928 cu. inches

(2)...
reams
125
20
‾‾‾‾
2500
24
‾‾‾‾
10000
5000
‾‾‾‾
60000 sheets

(3)...

| lb. |  | lb. |  | £ | s. |  |  |
|---|---|---|---|---|---|---|---|
| 112 | : | 43½ | :: | 3 | 10 | : | $x$ |
| 2 |  | 2 |  | 20 |  |  |  |
| 224 |  | 87 |  | 70 |  |  |  |

$$x = \frac{87 \times \overset{5}{\cancel{70}}}{\underset{16}{\cancel{224}}} = \frac{435}{16} \text{ sh.} = £1 \; 7s. \; 2\tfrac{1}{4}d.$$

(4)...

| cwt. |  | cwt. |  | mi. |  |  |
|---|---|---|---|---|---|---|
| 3¾ | : | 2¼ | :: | 75 | : | $x$ |
| 4 |  | 4 |  |  |  |  |
| 15 |  | 9 |  |  |  |  |

$$x = \frac{9 \times \overset{5}{\cancel{75}}}{\cancel{15}} = 45 \text{ miles}$$

(5)...

$$\begin{array}{cc} s. & d. \\ 17 & 6 \end{array}$$

$$4\times9\times10+5=365$$

$$\begin{array}{ccc} \overline{3} & \overline{10} & \overline{0} \\ & & 9 \\ \hline 31. & 10 & 0 \\ & & 10 \\ \hline 315 & 0 & 0 \\ 4 & 7 & 6 \\ \hline 319 & 7 & 6 \text{ annual expenditure} \end{array}$$

$$2 \text{ gui.} \times 12 = \begin{array}{ccc} 25 & 4 & 0 \text{ annual savings} \end{array}$$

$$\overline{£344 \quad 11 \quad 6} \text{ annual income}$$

(6)...

$$\begin{array}{llll} & s.\,d. & s. & d. \\ 52 \text{ lb. at } 4 & 0 = 208 & 0 \\ 78 \text{ lb. at } 4 & 5 = 344 & 6 \\ \hline 130 \text{ lb.} & 130)\overline{552 \quad 6}(4s.\ 3d. \\ & 520 \\ & \overline{32} \\ & 12 \\ & \overline{130)390(3d.} \\ & 390 \end{array}$$

(7)...

$$\begin{array}{ccccccccc} £ & s. & & s. & & £ & s. & d. \\ 3576 & 15 & : & 20 & :: & 1296 & 11 & 5\tfrac{1}{4} & : & x \\ 20 & & & & & 20 \\ \hline 71535 & & & & & \overline{25931} \\ & & & & & 12 \\ & & & & & \overline{311177} \\ & & & & & 4 \\ & & & & & \overline{1244709} \end{array}$$

$$x = \frac{\overset{4}{\cancel{20}} \times \overset{87}{\cancel{1244709}}}{\cancel{71535} \atop \cancel{14307}} = 348 \text{ far.} = 7s.\ 3d. \text{ in the } £$$

(8)...

$$\begin{array}{cccc} & t. & cwt. & qrs. & lb. \\ & 2 & 7 & 2 & 3\tfrac{1}{2} \\ 45 \text{ lb.} \times 13 = & 5 & 0 & 25 \\ \hline \text{net weight} = & 2 & 2 & 1 & 6\tfrac{1}{2} \end{array}$$

(9)...

$$\begin{array}{lcccc} & s. & d. & £ & s. & d. \\ 6 \text{ prs. Stockings at} & 2 & 6 = 0 & 15 & 0 \\ 3 \text{ „ Drawers at} & 4 & 9 = 0 & 14 & 3 \\ 4 \text{ „ Gloves at} & 2 & 3 = 0 & 9 & 0 \\ 3 \text{ Handkerchiefs} & 4 & 6 = 0 & 13 & 6 \\ \hline & & & £2 & 11 & 9 \end{array}$$

$$\begin{array}{ccc} £ & s. & d. \\ 3 & 0 & 0 \\ 2 & 11 & 9 \\ \hline \text{change} & 8s.\ 3d. \end{array}$$

(10)...

$$17 + 14 + 11 = 42$$
$$21s. \div 42 = 6d.$$
$$6d. \times 17 = 8s.\ 6d.$$
$$6d. \times 14 = 7s.$$
$$6d. \times 11 = 5s.\ 6d.$$

## *EXERCISE XXXIX.*

<table>
<tr><td>(1)...</td><td colspan="3">£   s.   d.</td></tr>
</table>

(1)...  59 gui. =  61  19   0  
   107 sov. =107   0   0  
   179 hf. cr. =  22   7   6  
             £191   6   6  

  415 hf. gui. = 217  17   6  
               191   6   6  
             £26  11   0  

(2)...473 + 116 = 589 greater no.  
              473  
          1767  
         4123  
        2356  
     278597  

(3)...  
   yds.   yds.   sq. yds.  
   $272 \times 242 = 65824$  

$$65824$$
$$4$$

$$30\tfrac{1}{4} \times 4 = 121 \begin{cases} 11)\overline{263296} \\ 11)\overline{23936} \\ 40)\overline{2176} \\ \phantom{40}4)\overline{54}\ 16\ per. \end{cases}$$

13 ac. 2 ro. 16 per.

(4)...1 qu. = 28   0  
    2 bu. =  7   0  
    1 bu. =  3   6  
    1 pk. =  0  10½  
          11   4½d.

(5)...  
  cwt. qrs. lb.    lb.    £   s.   d.  
   1   3   27½   :   1   ::   15   7   3¾   :   $x$  
   4            2        20  
   7            2      307  
  28                12  
 223             3687  
   2                4  
 447           14751  

$$x = \frac{2 \times \cancel{14751}^{33}}{\cancel{447}} = 66\ far. = 1s.\ 4\tfrac{1}{2}d.\ per\ lb.$$

(6)...1 cwt. 2 qrs. 16 lb. $\times$ 3 = 4 cwt. 3 qrs. 20 lb. = 552 lb.

$$\begin{array}{ccccc} \text{lb.} & & \text{lb.} & & s. \quad d. \\ 72 & : & 552 & :: & 2 \quad 3 \quad : \quad x \\ & & & & 12 \\ & & & & \overline{27} \end{array}$$

$$x = \frac{\overset{69}{\cancel{552}} \times \overset{3}{\cancel{27}}}{\underset{8}{\cancel{72}}} = 207d. = 17s.\ 3d.$$

(7)...    2 tons 17 cwt. 2 qrs. $\times$ 12 = $34\frac{1}{2}$ tons

$$\begin{array}{cc} s. & d. \\ 13 & 4 \\ & 3 \times 11 + 1\frac{1}{2} = 34\frac{1}{2} \\ \hline 40 & 0 \\ 11 \\ \hline 440 & 0 \\ 13 & 4 \\ 6 & 8 \end{array}$$

$$48 \left\{ \begin{array}{l} 4)\overline{460\quad 0} \\ \overline{12)115} \\ \hline \end{array} \right.$$

$$9\frac{7}{12} \text{ doz.} = 9 \text{ doz. } 7 \text{ bot.}$$

(8)...

$$\begin{array}{lccc} & \pounds & s. & d. \\ & 1 & 15 & 0 \\ & & & 5 \\ \hline & 8 & 15 & 0 \\ 2 \text{ qrs.} = 0 & 0 & 17 & 6 \\ 14 \text{ lb.} = 0 & 0 & 4 & 4\frac{1}{2} \\ 7 \text{ lb.} = 0 & 0 & 2 & 2\frac{1}{4} \\ \hline & \pounds 9 & 19 & 0\frac{3}{4} \end{array}$$

5 cwt. 2 qrs. 21 lb. = 637 lb.

$$\begin{array}{r} 4\frac{1}{2}d. \\ \hline 2548 \\ 318\frac{1}{2} \\ \hline 12)2866\frac{1}{2} \\ \hline 20)238\ 10\frac{1}{2} \\ \hline \end{array}$$

$$\begin{array}{lrrr} \text{selling price} & 11 & 18 & 10\frac{1}{2} \\ \text{cost price} & 9 & 19 & 0\frac{3}{4} \\ \hline \text{profit} & \pounds 1 & 19 & 9\frac{3}{4} \end{array}$$

feet

(9)... 1142

$4\frac{1}{2}$

―――

4568

571

3)5139

―――

1713 yds.

(10)...Dividends 4 $7\frac{1}{2}$ + 3 $8\frac{1}{2}$ + 1 11 = 10 3    *s. d.   s. d.   s. d.   s. d.*

20*s.* — 10*s.* 3*d.* = 9*s.* 9*d.* loss in the £

£    £ *s.*      *s. d.*

1 : 175 10 :: 9 9 : $x$

20    20      12

――    ――――    ――

20    3510      117

$$x = \frac{\overset{351}{\cancel{3510}} \times 117}{\underset{2}{\cancel{20}}} = \frac{41067}{2} d. = £85 \; 11s. \; 1\tfrac{1}{2}d.$$

## EXERCISE XL.

lb. oz.   lb. oz.   lb. oz.   lb. oz.

(1)... 3   6 + 4 10 + 6 14 = 14 14 = 238 ounces

7 cwt. 1 qr. 21 lb. = 13328 ounces

11328 ÷ 238 = 56 of each

                              *s.    d.   £   s.    d.*

$18\frac{1}{2}$ yds. Calico ......... 0   7 = 0 10   $9\frac{1}{2}$

11   ,,   Muslin ......... 1   3 = 0 13   9

$4\frac{1}{2}$  ,,   Diaper ......... 1   9 = 0   7 $10\frac{1}{2}$

$7\frac{1}{4}$  ,,   Bro. Holland... 0 11 = 0   6   $7\frac{3}{4}$

15   ,,   Flannel ......... 1   7 = 1   3   9

                                        £3   2   $9\frac{3}{4}$

           £    *s.    d.*        min.   min.    hrs.

(3)...120 gui. = 126   0   0   (4)... 7   :   5   ::   $19\frac{1}{4}$

             25 12   6                    4

            ―――――――                ――

           100   7   6                    77

               20                  11

             ――――

             2007            $x = \dfrac{5 \times \cancel{77}}{\cancel{7}} = 55$ qrs. = $13\frac{3}{4}$ hours

             12

365)24090(66*d.* = 5*s.* 6*d.*

    2190

    ――――

    2190

    2190

    ――――

cwt. qr. lb.　　　cwt. qrs. lb.　　　£　s.　d.
(5)... 3　1　10½　:　3　3　17　::　7　0　5¼　:　x
　　　 4　　　　　　　4　　　　　　　20
　　　 ‾13‾　　　　　‾15‾　　　　　‾140‾
　　　 28　　　　　　28　　　　　　12
　　　 ‾374‾　　　　‾437‾　　　　‾1685‾
　　　 2　　　　　　 2　　　　　　 4
　　　 ‾749‾　　　　‾874‾　　　　‾6741‾

$$x = \frac{874 \times 6741}{749} = 7866 \text{ far.} = £8 \ 3s. \ 10\tfrac{1}{2}d.$$

£　s.　d.　　　£　s.　d.　　　cwt. qrs. lb.
(6)... 6　11　5　:　9　3　8　::　2　3　24　:　x
　　　 20　　　　　　20　　　　　　4
　　　 ‾131‾　　　　‾183‾　　　　‾11‾
　　　 12　　　　　　12　　　　　　28
　　　 ‾1577‾　　　‾2204‾　　　‾332‾

$$x = \frac{2204 \times 332}{1577} = 464 \text{ lb.} = 4 \text{ cwt. } 16 \text{ lb.}$$

(7)...　　　　　　　　　　3 + 5 + 7 = 15

　　　　　　　　　　　　　£　 s.
　　　 3　:　15　::　2753　10
　　　　　　　　　　　　　　 5
　　　　　　　　　　‾£13767　10s.‾ value of property

　　　　　　　　　　　　　£　 s.
　　　 3　:　5　::　2753　10
　　　　　　　　　　　　　 5
　　　　　　　　　3)13767　10
　　　　　　　　　‾£4589　 3s. 4d.‾ B's share

　　　　　　　　　　　　　£　 s.
　　　 3　:　7　::　2753　10
　　　　　　　　　　　　　 7
　　　　　　　　　3)19274　10
　　　　　　　　　‾£6424　16s. 8d.‾ C's share

F

(8)...

| £ | s. | d. | | £ | s. | | yds. | | |
|---|----|----|---|---|----|---|------|---|---|
| 2 | 4 | 4½ | : | 15 | 15 | :: | 17¾ | : | $x$ |
| 20 | | | | 20 | | | 4 | | |
| $\overline{44}$ | | | | $\overline{315}$ | | | $\overline{71}$ | | |
| 12 | | | | 12 | | | | | |
| $\overline{532}$ | | | | $\overline{3780}$ | | | | | |
| 2 | | | | 2 | | | | | |
| $\overline{1065}$ | | | | $\overline{7560}$ | | | | | |

$$x = \frac{\overset{504}{\cancel{7560}} \times \cancel{71}}{\underset{\cancel{15}}{\cancel{1065}}} = 504 \text{ qrs.} = 126 \text{ yards}$$

(9)...

$$
\begin{array}{ccc}
£ & s. & d. \\
1 & 17 & 6 \\
& & 5\times5\times7=175 \\
\hline
9 & 7 & 6 \\
& & 5 \\
\hline
46 & 17 & 6 \\
& & 7 \\
\hline
328 & 2 & 6 \text{ value of sheep} \\
\end{array}
$$

$$23 \text{ gui.} \times 11 = \underline{265 \quad 13 \quad 0} \quad \text{,, ,, oxen}$$
$$£62 \quad 9 \quad 6$$

(10)...

$$
\begin{array}{cc}
\text{ft.} & \text{in.} \\
10 & 9 \\
& 12 \\
\hline
129 & 0 \text{ in 10 seconds} \\
6 & \\
\hline
774 & \text{per minute} \\
60 & \\
\hline
\end{array}
$$

3)46440 per hour

1760)15480(8 mi. 1400 yds.
14080
$\overline{\phantom{0}}$1400 yards

*EXERCISE XLI.*

(1)...
$$8090606$$
$$19003$$
$$\overline{24271818}$$
$$7281545400$$
$$8090606$$
$$323051)153745785818(475918$$
$$1292204$$
$$\overline{2452538}$$
$$2261357$$
$$\overline{1911815}$$
$$1615255$$
$$\overline{2965608}$$
$$2907459$$
$$\overline{581491}$$
$$323051$$
$$\overline{2584408}$$
$$2584408$$

(2)...
$$£ \quad s. \quad d.$$
$$239)1108 \quad 2 \quad 3\tfrac{1}{4}(£4 \ 12s. \ 8\tfrac{3}{4}d.$$
$$956$$
$$\overline{152}$$
$$20$$
$$239)3042(12s$$
$$2868$$
$$\overline{174}$$
$$12$$
$$239)2091(8d.$$
$$1912$$
$$\overline{179}$$
$$4$$
$$239)717(3 \text{ far.}$$
$$717$$

(3)...   3 wks. 19 hrs. 25 min. 15 sec. = 1884315 sec.
133 wks. 6 da. 19 hrs. 5 min. 45 sec. = 81025545 sec.
$$81025545 \div 1884315 = 43 \text{ times}$$

                ac.           ac.  ro. po.      £  s.  d.
(4)...          1    :      253  1  36   ::    1  13  4   :   $x$
                4           4                  20
               ――          ――――               ――
                4          1013                 33
               40            40                 12
              ――――        ―――――               ――――
              160        40556                 400

             20278    5

$$x = \frac{40556 \times 400}{160} = 101390d. = £422\ 9s.\ 2d.$$
$$\phantom{x=\frac{}{}} 2$$

         £  s.  d.                        £  s.  d.
(5)...   5  16  8              (6)...2   7  6
                6×7+1=43                   4×9×10+5=365
        ―――――――――                        ―――――――――――
        35   0  0                         9  10  0
             7                                 9
       ―――――――                           ――――――――
       245   0  0                        85  10  0
         5  16  8                               10
2 qrs.=  2  18  4                       ―――――――――
1 qr. =  1   9  2                       855   0  0
14 lb. = 0  14  7                        11  17  6
7 lb. =  0   7  3½                      ――――――――
       ――――――――――                       866  17  6
       £256  6  0½        4½ gui.×12=56  14  0
                                        ―――――――――
                                        £923  11  6

              £1000−£923 11s. 6d.=£76 8s. 6d.

(7)...              3 + 5 + 7 = 15
                    180°÷15 = 12°
                    12°×3 = 36°
                    12°×5 = 60°
                    12°×7 = 84°

           yds.          yds.         £   s.   d.
(8)...     29⅞    :      37¾   ::    12  13  11¼   :   $x$
            8             8           20
          ――――          ―――          ――――
          239           299          253
                                      12
                                     ――――――
                                     3047
                                        4
                                     ――――――
             51                      12189

$$x = \frac{299 \times 12189}{239} = 15249 \text{ far.} = £15\ 17s.\ 8¼d.$$

$$
\begin{array}{cccc}
£ & s. & £ & £ & s. & d. \\
\end{array}
$$

(9)...
$$
\begin{array}{llllllll}
& £ & s. & & £ & & £ & s. & d. \\
& 8562 & 10 & : & 1 & :: & 749 & 4 & 4\frac{1}{2} & : & x \\
& 2 & & & 2 & & & 20 & \\
\hline
& 17125 & & & 2 & & & 14984 & \\
& & & & & & & 12 & \\
\hline
& & & & & & & 179812 & \\
& & & & & & & 4 & \\
\hline
& & 42 & & & & & 719250 & \\
\end{array}
$$

$$x = \frac{2 \times 719250}{17125} = 84 \text{ far.} = 1s.\ 9d. \text{ in the } £$$

(10)...
$$126 \text{ gallons} = 63 \text{ dozen}$$

$$
\begin{array}{ll}
£ & s. \\
1 & 16 \\
 & 7 \times 9 = 63 \\
\hline
12 & 12 \\
 & 9 \\
\end{array}
$$

selling price = $\overline{113\quad 8}$

90 gui. = $\underline{\phantom{0}94\quad 10}$

profit $\overline{£18\quad 18}$

## EXERCISE XLII.

(1)...

1. $(476 + 359) \times (619 - 474)$
   $= 835 \times 145$
   $= 121075$

2. $(41857 - 14286) \div (215 + 134)$
   $= 27571 \div 349$
   $= 79$

$$
\begin{array}{cccc}
\text{mi.} & \text{fur.} & \text{po.} & \text{yds.} \\
19 & 5 & 27 & 4 \\
8 & & & \\
\hline
157 & & & \\
40 & & & \\
\hline
6307 & & & \\
5\frac{1}{2} & & & \\
\hline
31539 & & & \\
3153\frac{1}{2} & & & \\
\hline
34692\frac{1}{2} & & & \\
3 & & & \\
\hline
104077\frac{1}{2} \text{ feet} & & & \\
\end{array}
$$

sq. ft.

(3)...          9)976349                          *Proof.*

    $\overline{108483}$  2 sq. ft.          ac. ro. po. yds. ft.
                 4                            22  1  26  6  6½

$30\frac{1}{4}\times4=121\begin{cases} 11)\overline{433932} \\ 11)\overline{39448}\ \ 4 \\ 40)\overline{3586}\ \ 2 \end{cases}\bigg\}\ 26\text{ qrs.}=6\frac{1}{2}\text{ yds.}$          4
                                             $\overline{89}$
                                              40
                                             $\overline{3586}$
     $\overline{4)\ \ 89}$  26 po.              30¼
     $\overline{\ \ \ \ 22}$  1 ro.            $\overline{107586}$
                                              896½
*Ans.* 22 ac. 1 ro. 26 po. 6½ yds. 2 ft.      $\overline{108482\frac{1}{2}}$
   = 22 ac. 1 ro. 26 po. 6 yds. 6½ ft.           9

                                             $\overline{976349}$ sq. feet


(4)...          £3  17s.  3½d.  = 3710 farthings
                £305  6s.  0½d.  = 293090 farthings

          293090 ÷ 3710 = 79 times


|  |  | s. | d. | £ | s. | d. |
|---|---|---|---|---|---|---|
| (5)... | 10 Latin Grammars ... | 3 | 6 | = 1 | 15 | 0 |
|  | 8 Greek      „      ... | 4 | 0 | = 1 | 12 | 0 |
|  | 6 Virgils ............... | 7 | 6 | = 2 | 5 | 0 |
|  | 8 Latin Dictionaries... | 5 | 6 | = 2 | 4 | 0 |
|  | 4 Greek Lexicons  ... | 8 | 6 | = 1 | 14 | 0 |
|  |  |  |  | £9 | 10 | 0 |


(6)... January, February and March (1868) contain, together,
        91 days = 13 weeks

                 s.   d.
                13    6
                      13
              £8  15   6

(7)...

| ac. | ro. | per. | | ac. | | £ | s. | d. | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 5 | 2 | 30 | : | 1 | :: | 11 | 18 | 10½ | : | $x$ |

$$
\begin{array}{ccc}
\underline{4} & \underline{4} & \underline{\quad20} \\
22 & 4 & 238 \\
\underline{40} & \underline{40} & \underline{12} \\
910 & 160 & 2866 \\
& & \underline{\quad4} \\
& & 11466
\end{array}
$$

$$x = \frac{\cancel{160}^{32} \times \cancel{11466}^{63}}{\cancel{910}_{5}} = 2016 \text{ far.} = £2\ 2s. \text{ per acre}$$

| ac. | ro. | per. | | ac. | | £ | s. | d. | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 7 | 3 | 20 | : | 1 | :: | 17 | 14 | 4½ | : | $x$ |

$$
\begin{array}{ccc}
\underline{4} & \underline{4} & \underline{\quad20} \\
31 & 4 & 354 \\
\underline{40} & \underline{40} & \underline{12} \\
1260 & 160 & 4252 \\
& & \underline{\quad4} \\
& & 17010
\end{array}
$$

$$x = \frac{\cancel{160}^{80} \times \cancel{17010}^{27}}{\cancel{1260}_{7}} = 2160 \text{ far.} = £2\ 5s. \text{ per acre}$$

| cwt. | qrs. | lb. | | t. | cwt. | qr. | lb. | | £ | s. | d. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 15 | : | 3 | 14 | 1 | 9 | :: | 6 | 17 | 3 | : | $x$ |

$$
\begin{array}{ccc}
\underline{4} & \underline{20} & \underline{\quad20} \\
6 & 74 & 137 \\
\underline{28} & \underline{4} & \underline{12} \\
183 & 297 & 1647 \\
& \underline{28} & \\
& 8325 &
\end{array}
$$

$$x = \frac{8325 \times \cancel{1647}^{9}}{\cancel{183}} = 74925d. = £312\ 3s.\ 9d.$$

(9)...
$$
\begin{array}{cccccccc}
\text{in.} & & \text{in.} & & \text{yds.} & & \\
30\frac{1}{4} & : & 24\frac{3}{4} & :: & 60\frac{1}{2} & : & x \\
4 & & 4 & & 4 & & \\
\hline
121 & & 99 & & 242 & &
\end{array}
$$

$$
x = \frac{99 \times \overset{2}{\cancel{242}}}{\cancel{121}} = 198 \text{ qrs.} = 49\frac{1}{2} \text{ yards}
$$

(10)...
$$
\begin{array}{ccc}
\text{sq. yds.} & \text{sq. yds.} & \text{sq. yds.} \\
275 & + \ 330 & = 605 = 20 \text{ perches}
\end{array}
$$

$$
\begin{array}{ccccccc}
\text{per.} & & \text{ac. ro. per.} & & \text{hr.} & & \\
20 & : & 2 \ \ 3 \ \ 30 & :: & 1 & : & x \\
& & 4 & & & & \\
& & \overline{11} & & & & \\
& & 40 & & & & \\
& & \overline{470} & & & &
\end{array}
$$

$$
x = \frac{470}{20} = 23\frac{1}{2} \text{ hours}
$$

## EXERCISE XLIII.

(1)...
$$
\begin{array}{l}
1019)18281879(17941 \\
\underline{1019} \\
\ \ 8091 \\
\ \ \underline{7133} \\
\ \ \ \overline{9588} \\
\ \ \ 9171 \\
\ \ \ \ \overline{4177} \\
\ \ \ \ 4076 \\
\ \ \ \ \ \overline{1019} \\
\ \ \ \ \ \underline{1019}
\end{array}
$$

wks. da. hrs. min.

(2)...    19)145  2 14 55(7 wks. 4 da. 13 hrs. 25 min.
          133
          ——
           12
            7
        19)86(4 da.
           76
           ——
           10
           24
       19)254(13 hrs.
          19
          ——
          64
          57
          ——
           7
          60
        19)475(25 min.
           38
           ——
           95
           95
           ——

          s.   d.        £   s.   d.        yd.
(3)...    12   8   :    16  15   8   ::   1   :   $x$
          12             20
          ———            ———
          152            335
                          12
                         ————
                         4028

        $x = \dfrac{4028}{152} = \dfrac{53}{2} = 26\frac{1}{2}$ yards

                            s.   d.
(4)...                      3    6  per bottle
                                12
                            ——————
                            42   0  per dozen
                            45
                            ————
                            210

              d.        s.   168
36 gal. at 18 =  54)1890(35 barrels
                     162
                    ————
                     270
                     270
                     ——  ——

$$\text{(5)...}\quad \begin{array}{c}\text{cu. ft.}\\16750\end{array} : \begin{array}{c}\text{cu. ft.}\\1000\end{array} :: \begin{array}{ccc}£ & s. & d.\\3 & 15 & 4\frac{1}{2}\end{array} : x$$

$$\begin{array}{r}20\\\hline 75\\12\\\hline 904\\4\\\hline 3618\end{array}$$

$$x = \frac{\cancel{1000} \times \cancel{3618}^{54}}{\cancel{16750}_{67}^{4}} = 216 \text{ far.} = 4s.\ 6d. \text{ per thousand cu. ft.}$$

(6)...   4 cwt. 3 qrs. 21 lb. = 553 lb.

$$\begin{array}{r}6\\12)\overline{3318}\\20)\overline{276}\ \ 6\end{array}$$

$$\begin{array}{lrrr}\text{selling price} & 13 & 16 & 6\\\text{cost price} & 12 & 1 & 11\frac{1}{4}\\\hline \text{profit} & £1 & 14 & 6\frac{3}{4}\end{array}$$

$$\text{(7)...}\quad \begin{array}{c}\text{mi.}\\22\end{array} : \begin{array}{c}\text{mi.}\\18\end{array} :: \begin{array}{cc}\text{hrs.} & \text{min.}\\5 & 52\end{array} : x$$

$$\begin{array}{r}60\\\hline 352\end{array}$$

$$x = \frac{18 \times \cancel{352}^{16}}{\cancel{22}} = 288 \text{ min.} = 4 \text{ hrs. 48 min.}$$

(8)...   $37\frac{3}{4}$ yds. $\times 6 = 226\frac{1}{2}$ yds.

$$\begin{array}{ccc}\text{yds.} & \text{yds.} & £\ \ \ s.\ \ \ d.\\43\frac{1}{2} : & 226\frac{1}{2} :: & 1\ \ \ 3\ \ \ 6\frac{3}{4} : x\\2 & 2 & 20\\\hline 87 & \overline{453} & \overline{23}\\ & & 12\\ & & \overline{282}\\ & & 4\\ & & \overline{1131}\end{array}$$

$$x = \frac{453 \times \cancel{1131}^{13}}{\cancel{87}} = 5889 \text{ far.} = £6\ 2s.\ 8\frac{1}{4}d$$

(9)...     45 gal. + 7 gal. = 52 gal. = 26 dozen

$$
\begin{array}{rrr}
 & \pounds & s. & d. \\
57s.\ 6d. = & 2 & 17 & 6 \text{ per dozen} \\
 & & & 5 \times 5 + 1 = 26 \\
\hline
 & 14 & 7 & 6 \\
 & & & 5 \\
\hline
 & 71 & 17 & 6 \\
 & 2 & 17 & 6 \\
\hline
 & 74 & 15 & 0 \text{ selling price}
\end{array}
$$

55 gui. = 57  15   0 cost price

$\pounds 17$   0   0 profit

(10)...     2 qrs. $24\frac{1}{2}$ lb. × 313 = $25196\frac{1}{2}$ lb.

$$
\begin{array}{ccccccc}
\text{lb.} & & \text{lb.} & & s. & d. & \\
112 & : & 25196\frac{1}{2} & :: & 65 & 4 & : & x \\
2 & & 2 & & 12 & & \\
\hline
224 & & 50393 & & 784 & &
\end{array}
$$

7

$$x = \frac{50393 \times 784}{224} = \frac{352751}{2}d. = \pounds 734\ 17s.\ 11\frac{1}{2}d.$$

## EXERCISE XLIV.

(1)...     oz.
16)4763289
28)297705   9 oz.
4)10632   9 lb.
20)2658
132   18 cwt

*Ans.* 132 tons 18 cwt. 9 lb. 9 oz.

(2)...     yds.
347
$1s.\ 9\frac{1}{2}d. = \quad 21\frac{1}{2}d.$
347
694
$173\frac{1}{2}$
12)7460½
20)621   8½
$\pounds 31$   1s.  8½d.

(3)...     s.   d.   d.
3   9 = 45
31
45
135
1395

s.   d.   hf.d.   2
3   10½ = 93)2790(30 yards
279
. . 0

(4). .  
$$
\begin{array}{llllrrr}
 & & & & s. & d. & \pounds \quad s. \quad d. \\
14\tfrac{3}{4} \text{ yds.} & \text{Black Lutestring} & 3 & 8 & = & 2 & 14 \quad 1 \\
6\tfrac{1}{2} \text{ ,,} & \text{French Merino ...} & 3 & 9 & = & 1 & 4 \quad 4\tfrac{1}{2} \\
15\tfrac{1}{2} \text{ ,,} & \text{Bombazine \ ......} & 1 & 10 & = & 1 & 8 \quad 5 \\
6\tfrac{3}{4} \text{ ,,} & \text{Crape...............} & 2 & 9 & = & 0 & 18 \quad 6\tfrac{3}{4}
\end{array}
$$

$$\pounds \quad s. \quad d. \quad \pounds 6 \quad 5 \quad 5\tfrac{1}{4}$$

(5)...

$$
\begin{array}{lrrr}
\text{cost price} & 12 & 0 & 9 \\
\text{required profit} & 2 & 12 & 6 \\
\hline
\text{selling price} & 14 & 13 & 3
\end{array}
$$

$$
\begin{array}{lcccc}
\text{lb.} & & \text{lb.} & \pounds \quad s. \quad d. & \\
76\tfrac{1}{2} & : & 1 & :: \quad 14 \quad 13 \quad 3 & . \quad x \\
2 & & 2 & \quad 20 & \\
\hline
153 & & 2 & \quad 293 & \\
& & & \quad 12 & \\
\hline
& & & \quad 3519 &
\end{array}
$$

$$
x = \frac{2 \times \overset{23}{\cancel{3519}}}{\cancel{153}} = 46d. = 3s.\ 10d. \text{ per lb.}
$$

(6)...

$$
\begin{array}{lrrr}
 & \text{cwt.} & \text{qrs.} & \text{lb.} \\
 & 2 & 1 & 16 \\
 & 1 & 2 & 24 \\
\hline
\text{difference in weight} & 2 & & 20
\end{array}
$$

$$
\begin{array}{lclcll}
\text{qrs.} \ \text{lb.} & & \text{lb.} & & s. & d. \\
2 \quad 20 & : & 112 & :: & 2 & 4\tfrac{1}{2} \quad .. \quad x \\
28 & & & & 12 & \\
\hline
76 & & & & 28 & \\
& & & & \phantom{2}4 & \\
\hline
& & & & 114 &
\end{array}
$$

$$
x = \frac{\overset{56}{\cancel{112}} \times \overset{3}{\cancel{114}}}{\underset{\cancel{2}}{\cancel{76}}} = 168 \text{ far.} = 3s.\ 6d.
$$

(7)...

$$
\begin{array}{lclcll}
\text{min.} & & \text{min.} & & \text{hrs.} & \text{min.} \\
64 & : & 156 & :: & 4 & 30 \quad : \quad x \\
& & & & & 60 \\
\hline
& & & & & 270
\end{array}
$$

$$
x = \frac{\overset{39}{\cancel{156}} \times \overset{135}{\cancel{270}}}{\underset{\underset{8}{\cancel{16}}}{\cancel{64}}} = \frac{5265}{8} \text{ min.} = 10 \text{ hrs. } 58\tfrac{1}{8} \text{ min.}
$$

$$\begin{array}{llll}
\text{ac. ro. per.} & & \text{ac. ro. per.} & & \text{t. cwt.} \\
(8)\dots\quad 4 \ \ 1 \ \ 20 & : & 5 \ \ 3 \ \ 10 & :: & 12 \ \ 5 & : & x \\
\ \ \ \ \ \ 4 & & \ \ \ \ \ 4 & & \ \ \ \ 20 \\
\ \ \ \ \overline{17} & & \ \ \overline{23} & & \ \ \overline{245} \\
\ \ \ \ 40 & & \ \ \ 40 \\
\ \ \overline{700} & & \ \overline{930}
\end{array}$$

$$x = \frac{\overset{93}{\cancel{930}} \times \overset{7}{\cancel{245}}}{\underset{\underset{2}{\cancel{20}}}{\cancel{700}}} = \frac{651}{2} \text{ cwt.} = 16 \text{ tons } 5\tfrac{1}{2} \text{ cwt.}$$

(9)...    From March 5 to Dec. 22 = 292 days

$$\begin{array}{llll}
\text{da.} & & \text{da.} & & \pounds \ \ s. \\
365 & : & 292 & :: & 11 \ \ 15 & : & x \\
& & & & \ \ \ 20 \\
& & & & \overline{235}
\end{array}$$

$$x = \frac{\overset{4}{\cancel{292}} \times \overset{47}{\cancel{235}}}{\underset{\underset{5}{\cancel{365}}}{}} = 188s. = \pounds9 \ 8s.$$

(10)...    $20s. + 25s. + 30s. = 75$ shillings

$$\begin{array}{llll}
s. & & s. & & \pounds \\
75 & : & 20 & :: & 135 & : & x
\end{array}$$

$$x = \frac{\overset{4}{\cancel{20}} \times \overset{9}{\cancel{135}}}{\underset{\underset{15}{\cancel{75}}}{}} = \pounds36, \text{ A's share}$$

$$\begin{array}{llll}
s. & & s. & & \pounds \\
75 & : & 25 & :: & 135 & : & x
\end{array}$$

$$x = \frac{\overset{}{\cancel{25}} \times \overset{45}{\cancel{135}}}{\underset{\underset{3}{\cancel{75}}}{}} = \pounds45, \text{ B's share}$$

$$75 \overset{s.}{\phantom{.}} : \overset{s.}{30} :: \overset{\mathcal{L}}{135} : x$$

$$x = \frac{\overset{2}{\cancel{30}} \times \overset{27}{\cancel{135}}}{\underset{\underset{\cancel{5}}{\cancel{75}}}{\cancel{75}}} = \mathcal{L}54, \text{ C's share}$$

## EXERCISE XLV.

(1)...
```
E. ells qrs. na.  in.
   27   4   3   1¼
    5
  ───
  139
    4
  ───
  559
    2¼
 ─────
 1119¼
  139¾
 ─────
 1259 inches
```

(2)...From Easter Day to Whitsunday
```
     = 50 days
        24
      ─────
      1200
        60
      ─────
     72000 minutes
```

(3)...
```
      qrs. bu. pks. gal.
       19   5   2   1
        8
      ─────
      157
        4
      ─────
      630
        2
      ─────
     1261
        4
      ─────
     5044 quarts
```

(4)...
```
                  £   s.  d.
    37 hf. gui. = 19   8   6
   119 hf. cr.  = 14  17   6
                 ──────────
                 £4  11   0
```

(5)...
```
              £   s.   d.
             103   8   2¼
                        4
            ─────────────
13¾×4=55 ⎰ 5)413  12  11
         ⎱11) 82  14   7
             ─────────────
              £7  10   5
```

(6)...
```
              £   s.   d.
          ⎧ 2)1   5    8
     176 ⎨  8)   12   10
          ⎩11)    1    7½
             ──────────────
                      1¾d. per mile
```

| | | | d. | £ | s. | d. |
|---|---|---|---|---|---|---|
| (7)... | 45 yds. | Dimity | $9\frac{1}{2}$ | = 1 | 15 | $7\frac{1}{2}$ |
| | 27 „ | Calico | $4\frac{3}{4}$ | = 0 | 10 | $8\frac{1}{4}$ |
| | 56 „ | Chintz | $7\frac{1}{2}$ | = 1 | 15 | 0 |
| | 56 „ | Lining | 5 | = 1 | 3 | 4 |
| | 27 „ | Fringe | 10 | = 1 | 2 | 6 |

$$£6 \quad 7 \quad 1\frac{3}{4}$$

(8)... 6 cwt. 1 qr. $10\frac{1}{2}$ lb. $\times 7 = 44$ cwt. 1 qr. $17\frac{1}{2}$ lb.

| cwt. | qrs. | lb. | | cwt. | qr. | lb. | | £ | s. | d. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | 2 | $24\frac{1}{2}$ | : | 44 | 1 | $17\frac{1}{2}$ | :: | 12 | 0 | $2\frac{1}{4}$ | : | $x$ |
| 4 | | | | 4 | | | | | 20 | | | |
| 22 | | | | 177 | | | | | 240 | | | |
| 28 | | | | 28 | | | | | 12 | | | |
| 200 | | | | 1433 | | | | | 2882 | | | |
| 44 | | | | 354 | | | | | | 4 | | | |
| 640 | | | | 4973 | | | | | 11529 | | | |
| 2 | | | | 2 | | | | | | | | |
| 1281 | | | | 9947 | | | | | | | | |

$$x = \frac{9947 \times 11529}{1281} = 89523 \text{ far.} = £93 \ 5s. \ 0\frac{3}{4}d.$$

(9)... Dividends, 5 $7\frac{1}{2}$ + 3 $2\frac{1}{2}$ + 2 $4\frac{1}{2}$ = 11 $2\frac{1}{2}$ in the £

    Loss, 20s. − 11s. $2\frac{1}{2}d.$ = 8s. $9\frac{1}{2}d.$ in the £

| £ | | £ | | s. | d. | | |
|---|---|---|---|---|---|---|---|
| 1 | : | 575 | :: | 8 | $9\frac{1}{2}$ | : | $x$ |
| | | | | 12 | | | |
| | | | | 105 | | | |
| | | | | 4 | | | |
| | | | | 422 | | | |

$$x = 575 \times 422 = 242650 \text{ far.} = £252 \ 15s. \ 2\frac{1}{2}d.$$

(10)...     85 sq. yds. $\times 4 = 340$ sq. yds.

        53 „ $\times 5 = 265$ „

                605 „

    $4\frac{1}{2}$ acres = 21780 sq. yards

    $21780 \div 605 = 36$ hours

## EXERCISE XLVI.

|        | £ | s. | d. |
|--------|----|----|----|
| (1)...7 ten-pound notes | =70 | 0 | 0 |
| 49 sovereigns | =49 | 0 | 0 |
| 23 half sov. | =11 | 10 | 0 |
| 55 half cr. | = 6 | 17 | 6 |
| 113 sixpences | = 2 | 16 | 6 |

$$\overline{140\ \ 4\ \ 0}$$
$$20$$
$$\overline{2804}$$
$$3$$
$$\overline{8412}\ \text{fourp.}$$

(2)...

| ac. | ro. | per. |
|-----|-----|------|
| 23 | 2 | 29 |

$$4$$
$$\overline{94}$$
$$40$$
$$\overline{3789}$$
$$30\tfrac{1}{4}$$
$$\overline{113670}$$
$$947\tfrac{1}{2}$$
$$\overline{114617\tfrac{1}{4}}\ \text{sq. yds.}$$

(3)...

| cwt. | qrs. | lb. | oz. |
|------|------|-----|-----|
| 7 | 2 | 17 | 9 |
| 9 | 1 | 24 | 11 |
| 13 | 3 | 9 | 6 |
| 17 | 3 | 7 | 12 |
| 48 | 3 | 3 | 6 = 87414 ounces |

2 cwt. 3 qrs. 13 lb. 6 oz. = 5142 ounces

$$87414 \div 5142 = 17$$

(4)...   3 bu. 2 pks. = 14 pecks
21 qrs. 3 bu. 2 pks. = 686 pecks

$$686 \div 14 = 49\ \text{sacks}$$

(5)...

| ac. | ro. | sq. yds. |
|-----|-----|----------|
| 3 | 2 | 25 |

$$4$$
$$\overline{14}$$
$$40$$
$$\overline{560}$$
$$30\tfrac{1}{4}$$
$$\overline{16825}$$
$$140$$

145)16965(117 yards
$$145$$
$$\overline{246}$$
$$145$$
$$\overline{1015}$$
$$1015$$

(6)...
$$
\begin{array}{cc}
s. & d. \\
2 & 3\frac{1}{2} \\
12 \\
27 \\
2 \\
\hline
55
\end{array}
\quad : \quad
\begin{array}{ccc}
\pounds & s. & d. \\
626 & 1 & 2\frac{1}{2} \\
20 \\
\hline
12521 \\
12 \\
\hline
150254 \\
2 \\
\hline
300509
\end{array}
\quad :: \quad
\begin{array}{c}
\pounds \\
1
\end{array}
\quad : \quad x
$$

$$x = \frac{300509}{55} = \pounds 5463\frac{4}{5} = \pounds 5463 \ 16s.$$

(7)...
$$\text{Perimeter of ground} = \overset{\text{ft. in. ft. in.}}{(49 \ \ 6 + 38 \ \ 3)} \times 2$$
$$= 175 \text{ ft. } 6 \text{ in.}$$
$$= 2106 \text{ inches}$$

$$2106 \div 13\frac{1}{2} = 156 \text{ boards}$$

(8)...
$$\overset{\pounds \ \ \ s. \ d. \quad \ \ d. \qquad d.}{100 \div 6 \ \ 3} = 2400 \div 75 = 320, \text{ number of days}$$
The savings will have amounted to £100 on November 15.

(9)...
$$
\begin{array}{cc}
\text{E. ells} & \text{qrs.} \\
19 & 3 \\
5 \\
\hline
98
\end{array}
\quad : \quad
\begin{array}{cc}
\text{yds.} & \text{qr.} \\
47 & 1 \\
4 \\
\hline
189
\end{array}
\quad :: \quad
\begin{array}{ccc}
\pounds & s. & d. \\
3 & 13 & 6 \\
20 \\
\hline
73 \\
12 \\
\hline
882
\end{array}
\quad : \quad x
$$

$$x = \frac{189 \times \cancel{882}^{9}}{\cancel{98}} = 1701d. = \pounds 7 \ 1s. \ 9d.$$

(10)...
$$
\begin{array}{crrr}
& \pounds & s. & d. \\
& 3 & 10 & 0 \\
& & 13 & \\
\hline
& 45 & 10 & 0 \\
2 \text{ qrs.} = & 1 & 15 & 0 \\
1 \text{ qr.} = & 0 & 17 & 6 \\
\hline
& \pounds 48 & 2 & 6
\end{array}
\qquad
\begin{array}{crrr}
& \pounds & s. & d. \\
& 4 & 4 & 0 \\
& & 11 & \\
\hline
& 46 & 4 & 0 \\
2 \text{ qrs.} = & 2 & 2 & 0 \\
\hline
& \pounds 48 & 6 & 0
\end{array}
$$

$$
\begin{array}{lrrr}
& \pounds & s. & d. \\
\text{B's debt to A} = & 48 & 6 & 0 \\
\text{A's debt to B} = & 48 & 2 & 6 \\
\hline
\therefore \text{ B owes A} & & 3 & 6
\end{array}
$$

G

## EXERCISE XLVII.

(1)...
```
        834
        679
        7506
        5838
        5004
   97)566286(5838
        485
        812
        776
        368
        291
        776
        776
```

(2)...

| £ | s. | d. |
|---|----|----|
| 37 | 16 | 4¾ × 5 |
|  |  | 10 |
| 378 | 3 | 11½ × 3 |
|  |  | 10 |
| 3781 | 19 | 7 |
|  |  | 6 |
| 22691 | 17 | 6 |
| 1134 | 11 | 10½ |
| 189 | 1 | 11¾ |
| £24015 | 11 | 4¼ |

(3)...

```
                                              da.
    From Feb. 9, 1867, to Feb. 9, 1868  =  365
                  remainder of Feb.  „   =   20
                          March      „   =   31
                          April      „   =   30
                          May        „   =   31
                          June       „   =   30
                          to July 7   „   =    7
                                            514 days
```

(4)...

| | £ | s. | d. |
|---|---|----|----|
| | 86 | 12 | 6 |
| | 78 | 17 | 6 |
| profit on each share | 7 | 15 | 0 |
| | | | 5 × 5 = 25 |
| | 38 | 15 | 0 |
| | | | 5 |
| profit on 25 shares | £193 | 15 | 0 |

```
                                    £    s.    d.
(5)...                              2    6    0
                                              5
                                   ─────────────
                                   11   10    0
          1 rood      =   0   11    6
          20 perches  =   0    5    9
          10    ,,     =   0    2   10½
                          ──────────────
          rent of field = 12   10    1½
     50 bushels at 3s. 6d. =   8   15    0
                          ──────────────
          balance due = £3   15    1½
```

```
                                     s.   d.    £    s.   d.
(6)...  39  yds. Brussels Carpeting...  4   11  =  9   11   9
        27   ,,  Scotch      ,,    ...  2    8  =  3   12   0
        7½   ,,  Drugget ...............  2    9  =  1    0   7½
        6    ,,  Matting  ...............  2    3  =  0   13   6
        6½   ,,  Oil-cloth ...............  2    6  =  0   16   3
        2  Hearth-rugs  ...............23    6  =  2    7   0
                                                  ──────────────
                                                  £18   1   1½
```

```
(7)...           4 cwt. 2 qrs. 14 lb. = 518 lb.
                                      5d.
                                  ──────────
                               12)2590
                                  ──────────
                               20)215 10
                                  ──────────
               selling price      10  15  10
               cost price          9  14   3
                                  ──────────
                   profit = £1   1   7
```

```
            s.  d.   s.  d.   s.  d.      s.   d.
(8)...  Dividends 6  3½ +3  4½ +2  2½  = 11  10½ in the £

        Loss 20s.—11s. 10½d. = 8s. 1½d. in the £

     £         £          s.   d.        s.   d.
     1    :   5745   ::    8   1½    :    x
                          12
                         ─────
                          97
                           4
                         ─────
                         390

     x = 5745 × 390 = 2240550 far. = £2333  18s.  1½d.
```

(9)...  Area of field $=$ ($\overset{\text{yds.}}{245}\times\overset{\text{yds.}}{165}$) $=\overset{\text{sq. yds.}}{40425}=\overset{\text{sq. ft.}}{363825}$

Area of each garden $=$ 55 ft. $\times$ 35 ft. $=$ 1925 sq. ft.

```
1925)363825(189 gardens
     1925
     ―――――
     17132
     15400
     ―――――
      17325
      17325
      ――――― 
```

(10)...  By express train  $180\div40=4$ hours 30 minutes
By ordinary train $180\div25=7$ hours 12 minutes

```
                    hrs.  min.
                     7    12
                     4    30
                    ――――――――――
   time saved  =     2    42
```

<center>*EXERCISE XLVIII.*</center>

(1)...
```
        784
         25¾
       ――――
       3920
       1568
        392
        196
       ―――――
      20188
```

```
              16827
                  4
 19¾×4 =  79)67308(852
              632
             ―――――
              410
              395
             ―――――
              158
              158
             ―――――
```

$$
\begin{array}{ccc}
\pounds & s. & d. \\
138 & 4 & 4\frac{3}{4} \\
& & 2
\end{array}
$$

(2)...

$29\frac{1}{2} \times 2 = 59)\overline{276 \quad 8 \quad 9\frac{1}{2}}(\pounds 4 \ 13s. \ 8\frac{1}{2}d.$

$$
\begin{array}{r}
236 \\
\hline
40 \\
20 \\
\end{array}
$$

$59)\overline{808}(13s.$

$$
\begin{array}{r}
59 \\
\hline
218 \\
177 \\
\hline
41 \\
12 \\
\end{array}
$$

$\cdot 59)\overline{501}(8d.$

$$
\begin{array}{r}
472 \\
\hline
29 \\
4 \\
\end{array}
$$

$59)\overline{118}(2 \text{ far.}$

$$
\begin{array}{r}
118 \\
\hline
\end{array}
$$

(3)...

in.
$12)\overline{1676412}$
$3)\overline{139701}$
$220)\overline{46567}$
$8)\overline{211}$ 147 yds.
$\overline{26}$ 3 fur.

*Ans.* 26 mi. 3 fur. 147 yds.

(4)... 1 mile = 1760 yards

$$
\begin{array}{r}
35 \\
\hline
8800 \\
5280 \\
\hline
61600 \\
\end{array}
$$

sec. 3
1 hr. = $3600)\overline{184800}(51\frac{1}{3}$ ft.

$$
\begin{array}{r}
18000 \\
\hline
4800 \\
3600 \\
\hline
1200 \\
\end{array}
= \frac{1}{3}
$$
$$\frac{1200}{3600} = \frac{1}{3}$$

|  | ac. | ac. ro. per. | £ s. |  |
|---|---|---|---|---|
| (5)... | 1 : | 753 2 15 :: | 52 10 : | $x$ |
|  | 4 | 4 | 20 |  |
|  | 4 | 3014 | 1050 |  |
|  | 40 | 40 |  |  |
|  | 160 | 120575 |  |  |

$$x = \frac{120575 \times \cancel{1050}^{105}}{\cancel{100}^{16}} = \frac{12660375}{16} s. = £39563\ 13s.\ 5\tfrac{1}{4}d.$$

|  | oz. dwt. grs. | oz. dwt. grs. | £ s. d. |  |
|---|---|---|---|---|
| (6)... | 3 13 12 : | 17 9 12 :: | 14 4 9¾ : | $x$ |
|  | 20 | 20 | 20 |  |
|  | 73 | 349 | 284 |  |
|  | 24 | 24 | 12 |  |
|  | 304 | 1408 | 3417 |  |
|  | 146 | 698 | 4 |  |
|  | 1764 | 8388 | 13671 |  |

$$x = \frac{\cancel{8388}^{233} \times \cancel{13671}^{279}}{\cancel{1764}_{49}} = 65007\ far. = £67\ 14s.\ 3\tfrac{3}{4}d.$$

(7)...     3 cwt. 2 qrs. 8 lb. = 400 lb.

    400 lb. at 6½d. per lb. = £10 16s. 8d.

|  | £ s. d. | £ s. d. | lb. |  |
|---|---|---|---|---|
|  | 2 6 8 : | 10 16 8 :: | 112 : | $x$ |
|  | 20 | 20 |  |  |
|  | 46 | 216 |  |  |
|  | 12 | 12 |  |  |
|  | 560 | 2600 |  |  |

$$x = \frac{\cancel{2600}^{520} \times \cancel{112}}{\cancel{560}_{5}} = 520\ lb. = 4\ cwt.\ 2\ qrs.\ 16\ lb.$$

|  | d. | d. | £ s. d. |
|---|---|---|---|
| (8)... | 10 : | 7 :: | 17 14 7 |
|  |  |  | 7 |
|  |  |  | 10)124 2 1 |
|  |  |  | £12 8 2½ |

(9)...  12 cwt. × 240 = 2880 cwt. = 144 tons
8 cwt. × 40 = 320 cwt. = 16 tons
────────
160 tons

$$160 \begin{cases} 10)100 \quad 0 \quad 0 \\ \overline{4)10 \quad 0 \quad 0} \\ \overline{4)2 \quad 10 \quad 0} \end{cases}$$

£  s.  d.

                    12   6 per ton

(10)...  From noon, March 10 to 8 P.M. March 16 = 6⅓ days

min. sec.
Time gained in 1 day = 2  30
6⅓
─────────
15   0
50
─────────
Time gained in 6⅓ days = 15  50

∴ the clock, at the latter date, will show 15 min. 50 sec. past 8.

### EXERCISE XLIX.

(1)...  $(479)^2 = 479 \times 479 = 229441$
$(83)^3 = 83 \times 83 \times 83 = 571787$

(2)...  oz. dwt. grs.
11 13 17
15 14 19
17  9 13
──────────
44 18  1
20
────
898
24
─────
3593
1796
─────────
21553 grains

(3)...  125)1500000
─────────────
60)12000 minutes
──────────
200 hours
2
─────
11½ × 2 = 23)400(17 days
23
────
170
161
─────
9 hf. hrs. = 4½ hrs.

*Ans.* 17 days 4½ hours

(4)...              5 cwt. 25 lb. = 9360 ounces
                     7 lb. 6 oz. = 120 ounces

                     9360÷120 = 78 boxes

|  | cwt. | qr. | lb. |  | cwt. | qrs. | lb. |  | mi. |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|
| (5)... | 2 | 1 | 27 | : | 3 | 2 | 11 | :: | 45 | : | $x$ |
|  | 4 |  |  |  | 4 |  |  |  |  |  |  |
|  | 9 |  |  |  | 14 |  |  |  |  |  |  |
|  | 28 |  |  |  | 28 |  |  |  |  |  |  |
|  | 279 |  |  |  | 403 |  |  |  |  |  |  |

$$x = \frac{\overset{13}{\cancel{403}} \times \overset{5}{\cancel{45}}}{\underset{9}{\cancel{279}}} = 65 \text{ miles}$$

(6)...
$$35 \begin{cases} 5)\overline{\begin{array}{ccc} \text{ac.} & \text{ro.} & \text{per.} \\ 11 & 2 & 0 \end{array}} \\ 7)\overline{2 \quad 1 \quad 8} \end{cases}$$
                          1 ro. 12 per. 17⅔ yds.

(7)...30 inches × 108 = 3240 inches = 90 yards per minute

                7 miles = 12320 yards

                90)12320
                 60)136⅜ min.
                     2 hrs. 16⅜ min.

|  | £ | s. | d. |
|---|---|---|---|
| (8)... | 36 | 1 | 6 |
|  | 20 |  |  |
|  | 721 |  |  |
|  | 12 |  |  |

9s. 9d. = 117)8658(74 gallons
            819
            ___
            468
            468
            ___

            74 gallons of rum *and* water
            63 gallons of rum
            11 gallons of water

(9)...          16 cwt. 2 qrs. 24 lb. = 1872 lb.

lb. Av.       lb. Av.       lb. Tr.

144   :   1872   ::   175   :   $x$

13

$$x = \frac{1872 \times 175}{144} = 2275 \text{ lb. Troy}$$

|                       |   | £   | s. | d. |
|-----------------------|---|-----|----|----|
| (10)... 57293 penny stamps | = | 238 | 14 | 5 |
| 2347 twopenny „        | = | 19  | 11 | 2 |
| 564 fourpenny „        | = | 9   | 8  | 0 |
| 373 sixpenny „         | = | 9   | 6  | 6 |
| 253 ninepenny „        | = | 9   | 9  | 9 |
|                        |   | £286 | 9 | 10 |

## EXERCISE L.

|                        |   | £ | s. | d. |
|------------------------|---|---|----|----|
| (1)...  1 half sovereign | = | 0 | 10 | 0 |
| 4 half crowns          | = | 0 | 10 | 0 |
| 5 florins              | = | 0 | 10 | 0 |
| 69 shillings           | = | 3 | 9  | 0 |
| 67 sixpences           | = | 1 | 13 | 6 |
| 9 fourpenny pieces     | = | 0 | 3  | 0 |
| 26 threepenny pieces   | = | 0 | 6  | 6 |
| 89 pennies             | = | 0 | 7  | 5 |
| 93 halfpennies         | = | 0 | 3  | 10½ |
| 18 farthings           | = | 0 | 0  | 4½ |
| 1 Australian penny     | = | 0 | 0  | 1 |
| 1 Belgian halfpenny    | = | 0 | 0  | 0½ |
| 383 coins              |   | £7 | 13 | 9½ |

ac. ro. po.

(2)...9   0   35                          *Proof.*

4                              9)401568¾ sq. feet

36                                  44618¾

40                                      4

1475                       30¼ × 4 = 121 { 11)178475

30¼                                     { 11)16225

44250                                   40)1475

368¾                                     4)36   35 po.

44618¾                                    9 ac. 35 po.

9

401568¾ *sq. feet*

(3)...          1 yd. 3 qrs. 2 nails = 30 nails
          55 E. ells 2 qrs. 2 nails = 1110 nails

          $1110 \div 30 = 37$ lengths

(4)...  20s. − 7d. = 19s. 5d. remaining from each pound

| s. | d. | | £ | s. | d. | | £ | | |
|----|----|----|----|----|----|----|----|----|----|
| 19 | 5 | : | 713 | 11 | 3 | :: | 1 | : | x |
| 12 | | | | 20 | | | | | |
| 233 | | | 14271 | | | | | | |
| | | | 12 | | | | | | |
| | | | 171255 | | | | | | |

$$x = \frac{171255}{233} = £735, \text{ gross income}$$

(5)...      66 shillings = 198 fourpenny pieces
          1 lb. silver = 12 ounces
                          20
                         ————
                          240
                          24
                         ————
                          960
                          480
                  ⎧ 2)5760 grains
            198 ⎨ 9)2880
                  ⎩ 11)320
                      $29\frac{1}{11}$ grs. = 1 dwt. $9\frac{1}{11}$ grs.

|  | | s. | d. | £ | s. | d. |
|----|----|----|----|----|----|----|
| (6)... | 3 gross exercise books | 47 | 6 = | 7 | 2 | 6 |
| | 15 doz. copy books...... | 4 | 9 = | 3 | 11 | 3 |
| | 3  „  account books... | 23 | 6 = | 3 | 10 | 6 |
| | 3 reams foolscap paper | 14 | 6 = | 2 | 3 | 6 |
| | 10 gross steel pens...... | 2 | 9 = | 1 | 7 | 6 |
| | 4 doz. framed slates ... | 5 | 6 = | 1 | 2 | 0 |
| | | | | £18 | 17 | 3 |

$$
\begin{array}{cccccc}
\pounds & s. & d. & & \pounds & s. & d. & & \text{yds.} \\
\end{array}
$$

(7)...
$$
\begin{array}{ccccccc}
\pounds & s. & d. & & \pounds & s. & d. & & \text{yds.} \\
18 & 11 & 10\tfrac{1}{2} & : & 21 & 8 & 1\tfrac{1}{2} & :: & 29\tfrac{3}{4} & : & x \\
& 20 & & & & 20 & & & & 4 \\
\hline
& 371 & & & & 428 & & & & 119 \\
& 12 & & & & 12 & & & & \\
\hline
& 4462 & & & & 5137 & & & & \\
& 2 & & & & 2 & & & & \\
\hline
& 8925 & & & & 10275 & & & & \\
\end{array}
$$

$$
x = \frac{10275 \times 119}{8925} = 137 \text{ qrs.} = 34\tfrac{1}{4} \text{ yards}
$$

(8)...
$$
\begin{array}{lccccc}
 & s. & d. & \pounds & s. & d. \\
85\tfrac{1}{4} \text{ lb. tea} & 2 & 10 & = 12 & 1 & 6\tfrac{1}{2} \\
78\tfrac{1}{2} \text{ ,, ,,} & 3 & 3 & = 12 & 15 & 1\tfrac{1}{2} \\
\hline
163\tfrac{3}{4} & & & \pounds24 & 16 & 8 \\
\end{array}
$$

$$
\begin{array}{lccccc}
 & s. & d. & \pounds & s. & d. \\
163\tfrac{3}{4} \text{ lb. tea} & 3 & 4 & = 27 & 5 & 10 \\
\text{cost price} & & & = 24 & 16 & 8 \\
\text{profit} & & & \pounds2 & 9 & 2 \\
\end{array}
$$

(9)...
$$
\begin{array}{llccccc}
 & & s. & d. & & \pounds & s. & d. \\
21 \text{ men} & 2 & 9 & \text{per day each} & = & 2 & 17 & 9 \\
12 \text{ women} & 1 & 8 & \text{,,} \quad \text{,,} & = & 1 & 0 & 0 \\
27 \text{ boys} & 1 & 2 & \text{,,} \quad \text{,,} & = & 1 & 11 & 6 \\
\hline
 & & & & & 5 & 9 & 3 \quad \text{per day} \\
 & & & & & & & 6 \\
\hline
 & & & & & \pounds32 & 15 & 6 \quad \text{per week} \\
\end{array}
$$

|  |  | £ | s. | d. |
|---|---|---|---|---|
| (10)...14 lb. butter at 13d. per lb.............. = | | 0 | 15 | 2 |
| 40 eggs at 9d. per dozen ............... = | | 0 | 2 | 6 |
| 4 couples fowls at 3s. 3d. per couple = | | 0 | 13 | 0 |
| receipts = | | £1 | 10 | 8 |

|  |  | s. | d. |  | £ | s. | d. |
|---|---|---|---|---|---|---|---|
| 8½ lb. beef | at 0 | 7 | per lb. = | | 0 | 4 | 11½ |
| ½ ,, tea | ,, 3 | 10 | ,, = | | 0 | 1 | 11 |
| 3 ,, sugar | ,, 0 | 5½ | ,, = | | 0 | 1 | 4½ |
| 9½ yds. print | ,, 0 | 9 | per yd. = | | 0 | 7 | 1½ |
| 7 ,, calico | ,, 0 | 8 | ,, = | | 0 | 4 | 8 |
| 1 pair boots | | | = | | 0 | 8 | 6 |
| expenditure = | | | | | £1 | 8 | 6½ |

|  | £ | s. | d. |
|---|---|---|---|
| | 1 | 10 | 8 |
| | 1 | 8 | 6½ |
| money taken home = | | 2 | 1½ |

## EXERCISE LI.

(1)...A *Prime Number* is a number that is divisible only by
itself and by unity.

The *Greatest Common Measure* of two or more given num-
bers, is the greatest number that will divide each of the
given numbers exactly.

The *Least Common Multiple* of two or more given num-
bers, is the least number that is divisible by each of the
given numbers without a remainder.

(1)    23 29 31 37 41 43 47 53 59 61 67 71 73 79

(2)   1073)1421(1
         1073
         ―――
         348)1073(3
            1044        G. C. M. = 29
            ―――
            29)348(12
              29
             ――
              58
              58

(3)   2)4   5   6   7   8
      2)2  5  3  7  4
      ———————————
      1   5   3   7   2

$$\text{L.C.M.} = 2 \times 2 \times 5 \times 3 \times 7 \times 2 = 840$$

(2)...   *Proper Fractions*: $\frac{7}{9}$, $\frac{11}{15}$, $\frac{23}{29}$

      *Improper Fractions*: $\frac{8}{5}$, $\frac{11}{7}$, $\frac{19}{13}$

      *Mixed Numbers*: $3\frac{5}{7}$, $4\frac{2}{3}$, $17\frac{7}{11}$

      *Compound Fractions*: $\frac{1}{3}$ of $\frac{3}{5}$, $\frac{4}{7}$ of $\frac{5}{8}$ of $\frac{9}{11}$

      *Complex Fractions*: $\frac{\frac{3}{4}}{\frac{5}{7}}$, $\frac{3\frac{1}{2}}{5}$, $\frac{5}{7\frac{3}{4}}$, $\frac{3\frac{1}{2}}{7\frac{3}{4}}$

(3)...    $\dfrac{221}{272} \div \dfrac{17}{17} = \dfrac{13}{16}$; $\dfrac{285}{361} \div \dfrac{19}{19} = \dfrac{15}{19}$;

         $\dfrac{713}{989} \div \dfrac{23}{23} = \dfrac{31}{43}$.

(4)...    $17\frac{25}{36} = \dfrac{(17 \times 36) + 25}{36} = \dfrac{637}{36}$;

        $29\frac{19}{47} = \dfrac{(29 \times 47) + 19}{47} = \dfrac{1382}{47}$;

        $47\frac{73}{85} = \dfrac{(47 \times 85) + 73}{85} = \dfrac{4068}{85}$.

(5)... $\dfrac{547}{23} = 23\frac{18}{23}$;  $\dfrac{1087}{59} = 18\frac{25}{59}$;  $\dfrac{2377}{94} = 25\frac{27}{94}$

(6)...2*s*. 6*d*. = $\frac{1}{8}$ of £1

     3*d*. = $\frac{1}{10}$ of 2*s*. 6*d*.

     $\frac{3}{4}$*d*. = $\frac{1}{4}$ of 3*d*.

| £ | *s*. | *d*. | |
|---|---|---|---|
| 7597 | 0 | 0 | = value at £1 each |
| 949 | 12 | 6 | |
| 94 | 19 | 3 | |
| 23 | 14 | $9\frac{3}{4}$ | |
| £1068 | 6 | $6\frac{3}{4}$ | |

(7)...     1*s*. = $\frac{1}{20}$ of £1

        6*d*. = $\frac{1}{2}$ of 1*s*.

        $1\frac{1}{2}$*d*. = $\frac{1}{4}$ of 6*d*.

| £ | *s*. | *d*. |
|---|---|---|
| 42637 | 0 | 0 |
| 2131 | 17 | 0 |
| 1065 | 18 | 6 |
| 266 | 9 | $7\frac{1}{2}$ |
| £3464 | 5 | $1\frac{1}{2}$ |

$$\begin{array}{lrrr} & \pounds & s. & d. \\ \end{array}$$

(8)...        Value of stock = 1786  17  11

Value of furniture =   325   0   0

Total value of effects = 2111  17  11

$$\begin{array}{cc}\pounds & s.\\ 3782 & 10 \\ 2 & \\ \hline 7565 & \end{array} \quad : \quad \begin{array}{c}\pounds\\ 1\\ 2\\ \hline 2 \end{array} \quad :: \quad \begin{array}{ccc}\pounds & s. & d.\\ 2111 & 17 & 11\\ & & 20\\ \hline 42237 & & \\ 12 & & \\ \hline 506855 & & \end{array} \quad : \quad x$$

$$x = \frac{2 \times \overset{67}{\cancel{506855}}}{\cancel{7565}} = 134d. = 11s.\ 2d.\ \text{in the } \pounds$$

$$\begin{array}{lrrr} & \pounds & s. & d. \\ \end{array}$$

(9)...     108 gallons at $3\frac{1}{2}d.$ per quart = 6  6  0

profit = 1  8  6

cost   $\pounds4$  17  6

(10)...       $13 + 17 + 23 + 29 = 82$

$3526 \div 82 = 43$

$$\left.\begin{array}{l} 43 \times 13 = \phantom{0}559 \\ 43 \times 17 = \phantom{0}731 \\ 43 \times 23 = \phantom{0}989 \\ 43 \times 29 = 1247 \end{array}\right\} Answers$$

## EXERCISE LII.

| c.yds. | c.ft. | c.in. |
|---|---|---|

(1)...  43   0   573

       27

      301

       86

   1161

  1728

  9861

  2322

 8127

 1161

2006781 cu. inches

(2)...      56040 fourpenny pieces

           4

30)224160

     7472 half crowns

(3)...

| ac. | ro. | per. | yds. |
|---|---|---|---|
| 59 | 2 | 25 | 23 |

$3 \times 9 = 27$

178   3  37  $8\frac{1}{2}$

             9

1610  3  15  16

(4)...
$$\text{1 guinea} = 42 \text{ sixpences}$$
$$14$$
$$12\overline{)588}$$
$$49 \text{ dozen}$$

(5)...2s. 6d. = ⅛ of £1
1s. 3d. = ½ of 2s. 6d.
2d. = $\frac{1}{15}$ of 2s. 6d.

| £ | s. | d. | |
|---|----|----|---|
| 2319 | 0 | 0 | = value at £1 per sq. yd. |
| 289 | 17 | 6 | |
| 144 | 18 | 9 | |
| 19 | 6 | 6 | |
| £454 | 2 | 9 | |

(6)...
$$\frac{5}{7}+\frac{4}{9}+\frac{8}{15} = \frac{225+140+168}{315} = \frac{533}{315} = 1\frac{218}{315}$$

$$7\frac{4}{9}-3\frac{5}{8} = 7\frac{32}{72}-3\frac{45}{72} = 3\frac{59}{72}$$

(7)...
$$(\tfrac{4}{9} \text{ of } \tfrac{8}{11} \text{ of } 3\tfrac{3}{5}) \times (\tfrac{5}{7} \text{ of } \tfrac{3}{8} \text{ of } 3\tfrac{9}{11})$$

$$= \frac{4}{9}\times\frac{8}{11}\times\frac{18}{5}\times\frac{5}{7}\times\frac{3}{8}\times\frac{42}{11} = \frac{144}{121} = 1\frac{23}{121}$$

(8)...

| £ | s. | d. | |
|---|----|----|---|
| 2 | 4 | 0 | = value of 1 acre |
| | | | $11 \times 12 + 1 = 133$ |
| 24 | 4 | 0 | |
| | 12 | | |
| 290 | 8 | 0 | |

| | £ | s. | d. |
|---|---|----|----|
| 2 roods = ½ of 1 acre | | 2 | 4 | 0 |
| 1 rood = ½ of 2 roods | | 1 | 2 | 0 |
| 20 per. = ⅓ of 1 rood | | | 11 | 0 |
| 10 per. = ½ of 20 per. | | | 5 | 6 |
| 5 per. = ½ of 10 per. | | | 2 | 9 |
| 2½ per. = ½ of 5 per. | | | 1 | 4½ |
| | | | | 8¼ |
| | £294 | 15 | 3¾ |

<pre>
            s.  d.        £  s.   d.          cu. ft.
(9)...      4   6   :     4  4   4½   ::      1000   :   x
           12            20
           ──            ──
           54            84
            2            12
          ───           ────
          108           1012
                           2
                        ────
                        2025
</pre>

$$x = \frac{\cancel{2025}^{75} \times \cancel{1000}^{250}}{\cancel{108}^{4}} = 18750 \text{ cu. feet}$$

$18750 \div 150 = 125$ cubic feet per night

<pre>
                                s.  d.     £  s.  d.
(10)...      15 yds. flannel......1   9  = 1  6   3
             12 pairs stockings...1   8  = 1  0   0
                        A's debt =         2  6   3

                                s.  d.     £   s.  d.
              7 lb. tea ......8   9  =     1   6   3
              9 lb. coffee ...1   6  =         13  6
             10 lb. sugar ...     5½ =          4  7
                        B's debt =         2   4   4

                                           £  s.  d.
                                           2  6   3
                                           2  4   4
                                          ───────────
              A will have to pay B         1  11
</pre>

### EXERCISE LIII.

<pre>
                 £    s.  d.                      hrs. min.
(1)... 149 gui.  = 156  9   0   (2)...Monday      13  15
       237 sov.  = 237  0   0         Tuesday     24   0
       117 cr.   =  29  5   0         Wednesday   24   0
       235 hf. cr. = 29  7   6         Thursday    24   0
        67 fl.   =   6 14   0         Friday       18  35
       346 sh.   =  17  6   0                     ──────
       149 sixp. =   3 14   6                     103  50
        77 fourp. =  1  5   8                       60
                  ───────────                     ──────
                  £481  1   8                      6230 min.
</pre>

```
                      t.  cwt.  qr.  lb.   oz.
(3)...           43)15  18    1   27    3(7 cwt. 1 qr. 17 lb. 9 oz.
                    20
                   ───
                   318
                   301
                   ───
                    17
                     4
                 43)69(1 qr.
                    43
                    ──
                    26
                    28
                 43)755(17 lb.
                    43
                    ───
                    325
                    301
                    ───
                     24
                     16
                 43)387(9 oz.
                    387
                    ───
```

<div style="display:flex">

```
               s.   d.
(4)...         3    8 per lb.
                    7×11+2=79
                 ──────────
               1   5   8
                   11
               ─────────
              14   2   4
               7   4
8 oz. =        1  10
4 oz. =           11
2 oz. =            5½
              ──────────
             £14  12  10½
```

```
(5)...    3817      347     11
          ────  ÷   ───  =  ──
          5205      347     15

         10894      419     26
         ─────  ÷   ───  =  ──
         19693      419     47

         5)7  15  19  35
         7)7   3  19   7
         ─────────────
           1   3  19   1

   L.C.M. = 5×7×3×19 = 1995
```

</div>

$$(6)...\quad 5\tfrac{3}{4}+7\tfrac{2}{5}+9\tfrac{1}{7}+13\tfrac{5}{9} = 34+\tfrac{3}{4}+\tfrac{2}{5}+\tfrac{1}{7}+\tfrac{5}{9}$$

$$= 34+\frac{945+504+180+700}{1260}$$

$$= 34+\frac{2329}{1260}$$

$$= 35\tfrac{1069}{1260}$$

H

|  |  |  |  | *s.* | *d.* | | *s.* | *d.* |
|---|---|---|---|---|---|---|---|---|
| (7)... | 6 | prs. | Cotton Hose ......... | 2 | 3 | = | 13 | 6 |
|  | 4 | „ | Lambswool Hose ... | 2 | 9 | = | 11 | 0 |
|  | 9 | „ | Cotton Half-hose ... | 1 | 6 | = | 13 | 6 |
|  | 6 | „ | Kid Gloves ............ | 2 | 9 | = | 16 | 6 |
|  | $7\frac{1}{2}$ | yds. | Flannel ............... | 1 | 9 | = | 13 | $1\frac{1}{2}$ |
|  | 4 | Silk | Handkerchiefs ...... | 4 | 3 | = | 17 | 0 |

$$£4 \quad 4 \quad 7\frac{1}{2}$$

(8)...
$$65 \text{ gallons} = 520 \text{ pints}$$

$$520 \div 1\frac{5}{8} = \frac{\cancel{520}^{40}}{1} \times \frac{8}{\cancel{13}} = 320 \text{ bottles}$$

(9)...

| cwt. | qrs. | lb. |  | lb. |  | *s.* | *d.* |  |  |
|---|---|---|---|---|---|---|---|---|---|
| 2 | 3 | 21 | : | 112 | :: | 3 | 11 | : | $x$ |
| 4 |  |  |  |  |  | 12 |  |  |  |
| 11 |  |  |  |  |  | 47 |  |  |  |
| 28 |  |  |  |  |  |  |  |  |  |
| 329 |  | 16 |  |  |  |  |  |  |  |

$$x = \frac{\cancel{112} \times \cancel{47}}{\cancel{329}} = 16d. = 1s. \ 4d. \text{ per cwt.}$$

(10)...

| mi. |  | mi. |  |  | hr. | min. |
|---|---|---|---|---|---|---|
| $5\frac{2}{3}$ at the rate of | 4 per hour would occupy | | | | 1 | $22\frac{1}{2}$ |
| $81\frac{1}{4}$ „ | 25 „ | „ | | | 3 | 15 |
| $8\frac{1}{4}$ „ | 6 „ | „ | | | 1 | $22\frac{1}{2}$ |
| 95 miles | time occupied by journey = | | | | 6 | 0 |

Average rate per hour = $95 \div 6 = 15\frac{5}{6}$ miles

### EXERCISE LIV.

(1)... 1.    $(708 - 419 + 215) \times (614 + 219 - 376)$
      $= 589 \times 457$
      $= 269173$

     2.    $(24263 - 9879 + 11337) \div (826 - 537)$
      $= 25721 \div 289$
      $= 89$

(2)...
```
                        ac.  ro.  po.
                         9    3   36
                         4
                        ───
                        39
                        40
                       ────
                       1596
                         30¼
                      ─────
                      47880
                        399
                      ─────
                      48279
```
```
      yds.   hf. yds.     2
     115½  =   231)96558(418 yards
                   924
                   ───
                   415
                   231
                  ────
                  1848
                  1848
```

(3)...        36 gallons at 5d. per quart =
```
                                    £   s.  d.
                                    3   0   0
                            cost    2   0   6
                                   ──────────
                            profit     19   6
```

(4)...
```
                     £    s.  d.
                     1   17   6
                          9
                    ───────────
                    16   17   6  value of 1 ox
                     4
                    ───────────
                  3)67   10   0  value of 4 oxen
                   ───────────
                  £22   10   0  value of each horse
```

(5)...   $\frac{11}{16} - \frac{7}{13} = \frac{143}{208} - \frac{112}{208} = \frac{31}{208}$ ; $9 - 4\frac{6}{7} = 4\frac{1}{7}$ ;

$13\frac{2}{9} - 8\frac{5}{7} = 13\frac{14}{63} - 8\frac{45}{63} = 4\frac{32}{63}$

(6)...        $(\frac{5}{9}$ of $\frac{7}{12}$ of $3\frac{3}{4}) \times (\frac{3}{14}$ of $\frac{4}{5}$ of $8)$

$= \frac{5}{9} \times \frac{7}{12} \times \frac{15}{4} \times \frac{3}{14} \times \frac{4}{5} \times \frac{8}{1} = \frac{5}{3} = 1\frac{2}{3}$

H 2

(7)...
$$\tfrac{7}{8}\ \text{gui.} = \tfrac{7}{8} \times \tfrac{21}{1} = \underset{s.}{1\tfrac{147}{8}} = \underset{s.}{18}\ \underset{d.}{4\tfrac{1}{2}}\ ;$$
$$\tfrac{5}{12}\ \text{sov.} = \tfrac{5}{12} \times \tfrac{20}{1} = \tfrac{100}{12} = 8\ 4;$$
$$\tfrac{9}{16}\ \text{cro.} = \tfrac{9}{16} \times \tfrac{5}{1} = \tfrac{45}{16} = 2\ 9\tfrac{3}{4}$$

(8)...
$$\begin{array}{ccccccc} \text{men} & & \text{men} & & \text{da.} & & \\ 20 & : & 15 & :: & 42 & : & x \end{array}$$

$$x = \frac{\overset{3}{\cancel{15}} \times \overset{21}{\cancel{42}}}{\underset{\substack{4 \\ 2}}{\cancel{20}}} = \frac{63}{2}\ \text{da.} = 31\tfrac{1}{2}\ \text{da.} \quad Ans.\ \overset{\text{da.}}{31\tfrac{1}{2}} \times 2 = 63$$

(9)...
$$\begin{array}{llll|lll}
s. & d. & & & \pounds & s. & d. \\
5 & 0 & = \tfrac{1}{4}\ \text{of}\ \pounds 1 & & 1752 & 0 & 0 \quad = \text{value at } \pounds 1 \text{ eac} \\
2 & 6 & = \tfrac{1}{2}\ \text{,,}\ 5s. & & 438 & 0 & 0 \\
& 7\tfrac{1}{2} & = \tfrac{1}{4}\ \text{,,}\ 2s.\ 6d. & & 219 & 0 & 0 \\
& & & & 54 & 15 & 0 \\
\hline
& & & & \pounds 711 & 15 & 0
\end{array}$$

$$\begin{array}{llll|lll}
s. & d. & & & \pounds & s. & d. \\
10 & 0 & = \tfrac{1}{2}\ \text{of}\ \pounds 1 & & 967 & 0 & 0 \quad = \text{value at } \pounds 1 \text{ ea} \\
5 & 0 & = \tfrac{1}{2}\ \text{,,}\ 10s. & & 483 & 10 & 0 \\
2 & 6 & = \tfrac{1}{2}\ \text{,,}\ 5s. & & 241 & 15 & 0 \\
& 5 & = \tfrac{1}{6}\ \text{,,}\ 2s.\ 6d. & & 120 & 17 & 6 \\
& \tfrac{1}{4} & = \tfrac{1}{20}\ \text{,,}\ 5d. & & 20 & 2 & 11 \\
& & & & 1 & 0 & 1\tfrac{3}{4} \\
\hline
& & & & \pounds 867 & 5 & 6\tfrac{3}{4}
\end{array}$$

$$\begin{array}{llll|lll}
s. & d. & & & \pounds & s. & d. \\
10 & 0 & = \tfrac{1}{2}\ \text{of}\ \pounds 1 & & 589 & 0 & 0 \quad = \text{value at } \pounds 1 \text{ e} \\
& & & & & & 3 \\
\cline{5-7}
& & & & 1767 & 0 & 0 \\
2 & 6 & = \tfrac{1}{4}\ \text{,,}\ 10s. & & 294 & 10 & 0 \\
1 & 3 & = \tfrac{1}{2}\ \text{,,}\ 2s.\ 6d. & & 73 & 12 & 6 \\
& 2\tfrac{1}{2} & = \tfrac{1}{6}\ \text{,,}\ 1s.\ 3d. & & 36 & 16 & 3 \\
& & & & 6 & 2 & 8\tfrac{1}{2} \\
\hline
& & & & \pounds 2178 & 1 & 5\tfrac{1}{2}
\end{array}$$

(10)...
$$\begin{array}{l} \text{5 doz. Port.........}\overset{s.}{48} = \overset{s.}{240} \\ \text{6 ,, Sherry......}38 = 228 \end{array}$$

$$104)\overline{468}(4s\ 6d.\text{ per yard}$$
$$\underline{416}$$
$$\overline{52}$$
$$12$$
$$104)\overline{624}(6d.$$
$$\underline{624}$$

## EXERCISE LV.

(1)...
$$\begin{array}{r} 129 \\ 329 \\ \hline 1161 \\ 258 \\ 387 \\ 47)\overline{42441}(903 \\ \underline{423} \\ \hline 141 \\ \underline{141} \end{array}$$

or thus,
$$\frac{129 \times \cancel{329}}{\cancel{47}} \overset{7}{\phantom{x}} = 903$$

(2)...
$$\begin{array}{r} \text{lb.} \\ 28)756439 \\ 4)\ \overline{27015}\ \text{ 19 lb.} \\ 20)\ \overline{6753}\ \text{ 3 qrs.} \\ \overline{337}\ \text{ 13 cwt.} \end{array}$$

*Ans.* 337 t. 13 cwt. 3 qrs. 19 lb.

(3)...
$$\begin{array}{l} \qquad\qquad\qquad\quad £\ \ s.\ \ d. \\ 793\text{ sixpences} = 19\ \ 16\ \ 6 \\ 113\text{ hf. crowns} = 14\ \ \ 2\ \ 6 \\ \qquad\qquad\qquad £5\ \ 14\ \ \ 0 \end{array}$$

(4)...
$$\begin{array}{r} 629)777(1 \\ 629 \\ \hline 148)629(4 \\ 592 \\ \hline 37)148(4 \\ 148 \end{array}$$

$$\begin{array}{r} 37)1073(29 \\ 74 \\ \hline 333 \\ 333 \end{array}$$

G.C.M. required = 37

G.C.M. of 629 and 777 = 37

$$\begin{array}{r} 3)17\ \ 25\ \ 36\ \ 51\ \ 85 \\ 5)\overline{17\ \ 25\ \ 12\ \ 17\ \ 85} \\ 17)\overline{17\ \ \ 5\ \ 12\ \ 17\ \ 17} \\ \overline{1\ \ \ 5\ \ 12\ \ \ 1\ \ \ 1} \end{array}$$

L.C.M. = $3 \times 5 \times 17 \times 5 \times 12 = 15300$

(5)...
$$\frac{25}{42} \div \frac{5}{12} = \frac{\overset{5}{\cancel{25}}}{\underset{7}{\cancel{42}}} \times \frac{\overset{2}{\cancel{12}}}{\cancel{5}} = \frac{10}{7} = 1\tfrac{3}{7}$$

$$2\tfrac{2}{7} \div 6\tfrac{2}{5} = \frac{\cancel{16}}{7} \times \frac{5}{\underset{2}{\cancel{32}}} = \frac{5}{14}$$

(6)...
$$2\tfrac{3}{4} \ : \ 7\tfrac{6}{7} \ :: \ x \ : \ 19\tfrac{9}{14}$$

$$x = (2\tfrac{3}{4} \times 19\tfrac{9}{14}) \div 7\tfrac{6}{7} = \frac{11}{4} \times \frac{\overset{5}{\cancel{275}}}{\underset{2}{\cancel{14}}} \times \frac{7}{\cancel{55}} = \frac{55}{8} = 6\tfrac{7}{8}$$

(7)...     $12\frac{1}{2}$ gui. =
```
              £   s.  d.
             13   2   6
                        5 × 5 = 25
             ─────────
             65  12   6
                      5
             ─────────
            328   2   6  value of 25 oxen
            190   0   0
        65)138   2   6(£2 2s. 6d. each sheep
           130
           ───
             8
            20
        65)162(2s.
           130
           ───
            32
            12
        65)390(6d.
           390
           ───
```

(8)...
```
    hrs. da.        hrs.         tr.        tr.
    10 × 7    :    24 × x   ::   35    :    108
```

$$x = \frac{\overset{2}{\cancel{10}} \times \overset{}{7} \times \overset{9}{\cancel{108}}}{\underset{2}{\cancel{24}} \times \underset{5}{\cancel{35}}} = 9 \text{ days}$$

(9)...
$$12\tfrac{3}{4}+9\tfrac{3}{4}+7\tfrac{1}{2} = 30$$

1 sovereign $\div$ 30 = 8$d$.

$8d. \times 12\tfrac{3}{4} = 8s.\ 6d.$, John's share

$8d. \times 9\tfrac{3}{4} = 6s.\ 6d.$, George's share

$8d. \times 7\tfrac{1}{2} = 5s.\ 0d$, Edward's share

|  | £ | s. | d. |
|---|---|---|---|
| (10)... 1 quarter malt ......| 3 | 10 | 0 |
| 10 lb. hops at 2s. 6d. | 1 | 5 | 0 |
|  | £4 | 15 | 0 |

|  | £ | s. | d. |
|---|---|---|---|
| 3 bar. = 108 gal. at 16d. = | 7 | 4 | 0 |
| cost | 4 | 15 | 0 |
| profit | £2 | 9 | 0 |

*EXERCISE LVI.*

(1)...

ac. ro. po. yds.

9 2 27 19¼        *Proof.*

$$\begin{array}{l}4\\ \overline{38}\\ \quad 40 \\ \overline{1547}\\ \quad 30\tfrac{1}{4} \\ \overline{46429\tfrac{1}{4}}\\ \quad 386\tfrac{3}{4}\\ \overline{46816 \text{ sq. yds.}}\end{array}$$

46816 sq. yds.

4

yds.  qrs.

30¼ = 121

$$\begin{cases} 11)\overline{187264}\\ 11)\overline{17024}\\ \quad 40)\overline{1547}\ 7 \\ \quad\ \ 4)\overline{38}\ 27 \text{ poles}\\ \quad\quad \overline{9 \text{ ac. } 2 \text{ ro. } 27 \text{ po. } 19\tfrac{1}{4} \text{ yds.}} \end{cases}$$

} 77 qrs. = 19¼ yds.

(2)...

cu. in.

$$1728 \begin{cases} 12)\overline{3685824}\\ 12)\overline{307152}\\ 12)\overline{25596} \end{cases}$$

$$27 \begin{cases} 3)\overline{2133} \text{ cu. ft.}\\ 9)\overline{711} \end{cases}$$

79 cu. yds.

(3)...
$$315\begin{cases} 5)5616 \quad 2 \;\; 23 \;\; 3 \;\; 0 \\ 7)\overline{1123 \quad 1 \;\; 23 \;\; 48 \;\; 36} \\ 9)\overline{160 \quad 3 \;\; 6 \;\; 49 \;\; 48} \end{cases}$$

$$\overline{17 \;\; 5 \;\; 19 \;\; 25 \;\; 32}$$

w.  da. hrs. min. sec.

*Ans.* 17 w. 5 da. 19 hrs. 25 min. 32 sec.

(4)...
$$\frac{13}{18}\,\text{gui.} = \frac{13}{\overset{}{\underset{6}{\cancel{18}}}}\times\frac{\overset{7}{\cancel{21}}\overset{s.}{}}{1} = \frac{91}{6} = \overset{£\;\;s.\;\;d.}{0\;\;15\;\;2}$$

$$\frac{19}{24}\,\text{sov.} = \frac{19}{\overset{}{\underset{6}{\cancel{24}}}}\times\frac{\overset{5}{\cancel{20}}}{1} = \frac{95}{6} = 0\;\;15\;\;10$$

$$\underline{\phantom{xxxxxxxxx}£1\;\;11\;\;0}$$

(5)...1.
```
    s.  d.                      £    s.   d.
   10  0  = ½ of £1         547   0   0  = value at £1 per yd
    1  8  = ⅙ of 10s.      273  10   0
    2½    = ⅛ of 1s. 8d.    45  11   8
                             5  13  11½
                           ─────────────
                          £324  15   7½
```

2.
```
   qr.lb.                    £    s.   d.
    1  0  = ¼ of 1 cwt.      4    4   0  per cwt.
                                        4
                           ──────────────
                            16   16   0
   14    = ½ of 1 qr.        1    1   0
    7    = ½ of 14 lb.            10   6
    3½   = ½ of 7 lb.              5   3
                                  2   7½
                           ──────────────
                           £18   15   4½
```

3.
```
   ro. per.                  £    s.   d.
    2  0  = ½ of 1 ac.       1   16   0  per acre
                                    12×12+5 = 149
                           ──────────────
                            21   12   C
                                     12
                           ──────────────
                           259    4   0
                             9    0   0
   20 = ¼ of 2 ro.               18   0
    5 = ¼ of 20 p.                4   6
                                  1   1½
                           ──────────────
                          £269    7   7½
```

| | | s. | d. | £ | s. | d. |
|---|---|---|---|---|---|---|
| (6)... | 12 Mahogany chairs............ | 32 | 6 = | 19 | 10 | 0 |
| | 2 Arm-chairs ................. | 38 | 6 = | 3 | 17 | 0 |
| | 49½ yds. Brussels carpeting... | 4 | 10 = | 11 | 19 | 3 |
| | 1 Hearth-rug ................. | | | 1 | 8 | 6 |
| | 18 yds. Crimson damask...... | 3 | 9 = | 3 | 7 | 6 |
| | | | | £40 | 2 | 3 |

(7)...
$$\frac{5}{9} \quad : \quad \frac{3}{16} \quad :: \quad \overset{£}{10225} \quad : \quad x$$

$$\frac{9}{\cancel{5}} \times \frac{3}{16} \times \frac{\overset{2045}{\cancel{10225}}}{1} = £\frac{55215}{16} = £3450 \; 18s. \; 9d.$$

(8)...
$$\overset{s. \quad da.}{62 \times 14} \quad : \quad \overset{s. \quad da.}{126 \times 62} \quad :: \quad \overset{t.}{3} \quad : \quad x$$

$$x = \frac{\overset{9}{\cancel{126}} \times \cancel{62} \times 3}{\cancel{62} \times \cancel{14}} = 27 \text{ tons}$$

(9)... The first is to receive *a certain sum;*

The second £117 9s. 6d. less than this sum;

The third (£117 9s. 6d. + £94 7s. 6d.) less.

| | £ | s. | d. |
|---|---|---|---|
| | 1358 | 11 | 0 |

| | £ | s. | d. | | | | |
|---|---|---|---|---|---|---|---|
| | 117 | 9 | 6 | } | 329 | 6 | 6 |
| | 117 | 9 | 6 | = | | | |
| | 94 | 7 | 6 | | | | |

3)1687 17 6

| | | £ | | |
|---|---|---|---|---|
| The first will receive | £562 | 12 | 6 |
| | 117 | 9 | 6 |
| The second ,, | £445 | 3 | 0 |
| | 94 | 7 | 6 |
| The third ,, | £350 | 15 | 6 |

(10)...From noon to 8 A.M. on the following day $= 20$ hours

The clock will gain $\dfrac{20}{24}$ or $\dfrac{5}{6}$ of $4\frac{1}{2}$ min. in 20 hours

$$\dfrac{5}{6} \text{ of } 4\frac{1}{2}\overset{\text{min.}}{} = \dfrac{5}{\cancel{6}_{2}} \times \dfrac{\cancel{9}^{3}}{2} = \dfrac{15}{4} = 3\frac{3}{4} \text{ minutes}$$

∴ the hands must be set at $3\frac{3}{4}$ minutes before 12

### EXERCISE LVII.

(1)...

        far.
4)236565
12)59141¼
21)4928  5¼
gui. 234 14s. 5¼d.

(2)...

| ac. | ro. | po. | yds. |
|---|---|---|---|
| 79 | 2 | 24 | 15 |
| | | $3 \times 6 + 1 = 19$ | |
| 238 | 3 | 33 | 14¾ |
| | | | 6 |
| 1433 | 3 | 0 | 28 |
| 79 | 2 | 24 | 15 |
| 1513 | 1 | 25 | 12¾ |

(3)... From March 19 to May 31 $= 73$ days $= \frac{1}{5}$ year

$$\begin{array}{cccc} \pounds & s. & d. \\ 5)13 & 2 & 6 \end{array} = 12\frac{1}{2} \text{ guineas}$$

$$\overline{\pounds 2 \quad 12 \quad 6}$$

(4)...

$$\left(\tfrac{5}{8} \text{ of } \tfrac{7}{10}\right) \times \left(\tfrac{3}{5} \text{ of } \tfrac{10}{11}\right)$$
$$= \dfrac{\cancel{5}}{8} \times \dfrac{7}{\cancel{10}} \times \dfrac{3}{\cancel{5}} \times \dfrac{\cancel{10}}{11} = \dfrac{21}{88} ;$$

$$\left(\tfrac{4}{5} \text{ of } 6\tfrac{1}{4}\right) \times \left(\tfrac{3}{7} \text{ of } 2\tfrac{4}{5}\right)$$
$$= \dfrac{\cancel{4}}{\cancel{5}} \times \dfrac{\cancel{25}^{5}}{\cancel{4}} \times \dfrac{3}{7} \times \dfrac{\cancel{14}^{2}}{\cancel{5}} = 6$$

(5)...　　　　2 qrs. 19¼ lb. = 301 quarter lb.
　　　　　　　　1 cwt. = 448　　　,,

$$\frac{301}{448} = \frac{43}{64} \text{ of a cwt.}$$

$$\frac{23}{28}\text{gui.} = \frac{23}{\cancel{28}_4}\times\frac{\overset{3}{\cancel{21}}}{1} = \frac{69}{4}s. = 17s.\ 3d.$$

(6)...
|  | £ | s. | d. |
|---|---|---|---|
|  | 2 | 15 | 0 |
|  | 1 | 10 | 6 |

£200 18s. 6d. ÷ £4  5  6 = 47

∴ the number of persons = 47 × 2 = 94

(7)...
　　　　　　　　　£　s.　d.
　　　　　　　　　5　10　0 per cwt.
　　　　　　　　　　　　4×4+1 = 17
　　　　　　　　　22　0　0
　　　　　　　　　　　　4

qr. lb.
2　0　= ½ of 1 cwt. | 88　0　0
1　0　= ½ of 2 qrs. | 5　10　0
　14　= ½ of 1 qr. | 2　15　0
　3½ = ¼ of 14 lb. | 1　7　6
　　　　　　　　　　　　13　9
　　　　　　　　　　　　3　5¼
　　　　　　　　£98　9　8¼

(8)...
per. da.　　per. da.　　£
8×15　:　14×42　::　39　.　x

$$x = \frac{\overset{7}{\cancel{14}}\times\overset{7}{\cancel{42}}\times 39}{\underset{\underset{2}{4}}{\cancel{8}}\times\underset{5}{\cancel{15}}} = £\frac{1911}{10} = £191\ 2s.$$

(9)...  Value of 1 sheep $= \frac{3}{5}$ of that of a calf

 ∴ 13 sheep are equal in value to $(\frac{3}{5} \times 13 =) \frac{39}{5}$ calves

and 27  „  „  $(\frac{3}{5} \times 27 =) \frac{81}{5}$ „

$$5 + \frac{39}{5} = \frac{64}{5}; \ 7 + \frac{81}{5} = \frac{116}{5}$$

$$\underset{\frac{64}{5}}{\text{c.}} \ : \ \underset{\frac{116}{5}}{\text{c.}} \ :: \ \underset{36 \ 16}{£ \ s.} = 36\frac{4}{5} \ : \ \underset{x}{£}$$

$$x = \frac{\cancel{5}}{\cancel{64}} \times \frac{\overset{29}{\cancel{116}}}{\cancel{5}} \times \frac{\overset{23}{\cancel{184}}}{5} = £\frac{667}{10} = £66 \ 14s.$$

(10)... He walked 10 miles in 2 hrs. 40 min. or 160 min.

 ∴ he walked at the rate of 1 mile in 16 minutes

$$\text{time occupied by journey} = \underset{\text{min.}}{16} \times 22 = \underset{\text{min.}}{352} = 5 \text{ hrs. } 52 \text{ min.}$$

$$5 \text{ hrs. } 52 \text{ min.} + 30 \text{ min.} = 6 \text{ hrs. } 22 \text{ min.}$$

hence he reached Windsor at 22 min. past 3

<p align="center"><em>EXERCISE LVIII.</em></p>

| | | | | | s. | d. | | £ | s. | d. |
|---|---|---|---|---|---|---|---|---|---|---|
| (1)... | $4\frac{1}{4}$ | lb. | Jamaica coffee | ... | 1 | 8 | = | 0 | 7 | 1 |
| | $3\frac{1}{2}$ | „ | Mocha „ | ... | 1 | 10 | = | 0 | 6 | 5 |
| | $2\frac{1}{2}$ | „ | Tea | ... | 4 | 4 | = | 0 | 10 | 10 |
| | 15 | „ | Sugar | ... | 0 | $5\frac{1}{2}$ | = | 0 | 6 | $10\frac{1}{2}$ |
| | $3\frac{1}{2}$ | „ | Honey | ... | 1 | 3 | = | 0 | 4 | $4\frac{1}{2}$ |
| | 6 | „ | Treacle | ... | 0 | 4 | = | 0 | 2 | 0 |
| | 4 | boxes | Sardines | ... | 1 | 2 | = | 0 | 4 | 8 |
| | | | | | | | | £2 | 2 | 3 |

(2)... 1 gui. + 1 sov. + 1 cr. + 1 fl. $= £2$ 8s. $= 2304$ far.

<div align="center">

2304)292608(127 of each coin  
2304  
―――  
6220  
4608  
―――  
16128  
16128  

</div>

(3)... 

$$4\tfrac{7}{12} + 3\tfrac{3}{8} = 4\tfrac{14}{24} + 3\tfrac{9}{24} = 7\tfrac{23}{24}\text{, sum}$$

$$4\tfrac{7}{12} - 3\tfrac{3}{8} = 4\tfrac{14}{24} - 3\tfrac{9}{24} = 1\tfrac{5}{24}\text{, difference}$$

$$4\tfrac{7}{12} \times 3\tfrac{3}{8} = \frac{55}{\overset{}{\underset{4}{12}}} \times \frac{\overset{9}{27}}{8} = \frac{495}{32} = 15\tfrac{15}{32}\text{, product}$$

$$4\tfrac{7}{12} \div 3\tfrac{3}{8} = \frac{55}{\underset{3}{12}} \times \frac{\overset{2}{8}}{27} = \frac{110}{81} = 1\tfrac{29}{81}\text{, quotient}$$

$$7\tfrac{23}{24} + 1\tfrac{5}{24} + 15\tfrac{15}{32} + 1\tfrac{29}{81}$$
$$= 24 + \tfrac{23}{24} + \tfrac{5}{24} + \tfrac{15}{32} + \tfrac{29}{81}$$
$$= 24 + \frac{2484 + 540 + 1215 + 928}{2592}$$
$$= 24 + \tfrac{5167}{2592}$$
$$= 24 + 1\tfrac{2575}{2592}$$
$$= 25\tfrac{2575}{2592}$$

**(4)...**

1. $\frac{3}{5} + \frac{7}{10} - \frac{11}{30} + \frac{8}{15} = \frac{18}{30} + \frac{21}{30} - \frac{11}{30} + \frac{16}{30}$
$$= \tfrac{44}{30} = \tfrac{22}{15} = 1\tfrac{7}{15}$$

2. $(1\tfrac{5}{9} - 2\tfrac{1}{6} + 3\tfrac{7}{12}) \times \tfrac{18}{25}$
$$= (1\tfrac{20}{36} - 2\tfrac{6}{36} + 3\tfrac{21}{36}) \times \tfrac{18}{25}$$
$$= 2\tfrac{35}{36} \times \tfrac{18}{25}$$
$$= \frac{107}{\underset{2}{36}} \times \frac{18}{25}$$
$$= \tfrac{107}{50} = 2\tfrac{7}{50}$$

**(5)...**

$$\frac{7}{20}\text{ mi.} = \frac{7}{20} \times \frac{\overset{88}{1760}}{1} = 616\ \text{yds.}$$

$$\frac{8}{11}\text{ fur.} = \frac{8}{11} \times \frac{\overset{20}{220}}{1} = \frac{160}{456}\ \text{yards}$$

$$
\begin{array}{cccccccc}
 & s. & d. & & \mathcal{L} & s. & d. & & \mathcal{L} \\
(6)\ldots & 1 & 6 & : & 380 & 1 & 3 & :: & 1 & : & x \\
 & 12 & & & 20 \\
 & \overline{18} & & & \overline{7601} \\
 & & & & 12 \\
 & & & & \overline{91215}
\end{array}
$$

$$
x = \frac{91215}{18} = \pounds 5067 \; 10s.
$$

$$
(7)\ldots \quad \frac{\overset{5}{\cancel{140}} \times \overset{21}{\cancel{84}}}{\underset{4}{\cancel{112}}} = 105 \text{ yards}
$$

$$
\begin{array}{lrrl}
 & \mathcal{L} & s. & d. \\
(8)\ldots & 3 & 17 & 6 \text{ per ounce} \\
 & & & 3 \times 6 + 1 = 19 \\
\cline{2-4}
 & \overline{11} & \overline{12} & 6 \\
 & & & 6
\end{array}
$$

| dwt. | grs. | | £ | s. | d. |
|---|---|---|---|---|---|
| | | | 69 | 15 | 0 |
| 10 | 0 | $= \frac{1}{2}$ of 1 oz. | 3 | 17 | 6 |
| 5 | 0 | $= \frac{1}{2}$ of 10 dwt. | 1 | 18 | 9 |
| 2 | 12 | $= \frac{1}{2}$ of 5 dwt. | 0 | 19 | $4\frac{1}{2}$ |
| | | | 0 | 9 | $8\frac{1}{4}$ |
| | | | £77 | 0 | $3\frac{3}{4}$ |

| qrs. | lb. | | £ | s. | d. |
|---|---|---|---|---|---|
| 2 | 0 | $= \frac{1}{2}$ of 1 cwt. | 3 | 10 | 0 per cwt. |
| | | | | | 13 |
| | | | 45 | 10 | 0 |
| 1 | 0 | $= \frac{1}{2}$ of 2 qrs. | 1 | 15 | 0 |
| | 14 | $= \frac{1}{2}$ of 1 qr. | 0 | 17 | 6 |
| | $3\frac{1}{2}$ | $= \frac{1}{4}$ of 14 lb. | 0 | 8 | 9 |
| | | | 0 | 2 | $2\frac{1}{4}$ |
| | | | £48 | 13 | $5\frac{1}{4}$ |

| bu. | pks. | | £ | s. | d. |
|---|---|---|---|---|---|
| 4 | 0 | $= \frac{1}{2}$ of 1 qr. | 2 | 16 | 0 per qr. |
| | | | | | 11 |
| | | | 30 | 16 | 0 |
| 1 | 0 | $= \frac{1}{4}$ of 4 bu. | 1 | 8 | 0 |
| | 2 | $= \frac{1}{2}$ of 1 bu. | 0 | 7 | 0 |
| | | | 0 | 3 | 6 |
| | | | £32 | 14 | 6 |

(9)...

$$\begin{array}{ccc} \pounds & s. & d. \\ 18)229 & 10 & 0 \\ \hline 12 & 15 & 0 \text{ cost of each ox} \\ & & 5 \\ \hline \pounds 63 & 15 & 0 \text{ produce of 5 oxen} \end{array}$$

$$\begin{array}{ccc} \pounds & s. & d. \\ 229 & 10 & 0 \\ 63 & 15 & 0 \\ \hline 165 & 15 & 0 \text{ cost of 13 oxen} \\ 32 & 10 & 0 \text{ required profit} \\ \hline 13)198 & 5 & 0 \\ \hline \pounds 15 & 5 & 0 \text{ each} \end{array}$$

(10)...

$$\begin{array}{cccc} \text{hrs. wks.} & \text{hrs. wks.} & \pounds & s. \\ 11 \times 8 & : & 14 \times 9 & :: & 42 & 7 & : & x \\ & & & & 20 \\ & & & & \overline{847} \end{array}$$

$$x = \frac{\overset{7}{\cancel{14}} \times 9 \times \overset{77}{\cancel{847}}}{\underset{4}{\cancel{11} \times \cancel{8}}} = \frac{4851}{4}s. = \pounds 60 \ 12s. \ 9d.$$

## EXERCISE LIX.

(1)...
$$\begin{array}{l} \text{in.} \\ 12)4876329 \\ \hline 3)406360 \quad 9 \text{ in.} \\ \hline 220)135453 \quad 1 \text{ ft.} \\ \hline 8) \ \ 615 \quad 153 \text{ yds.} \\ \hline 76 \quad 7 \text{ fur.} \end{array}$$

**Ans.** 76 mi. 7 fur. 153 yds. 1 ft. 9 in.

(2)...
$$\frac{561}{759} + \frac{33}{33} = \frac{17}{23};$$

$$\frac{1645}{2209} \div \frac{47}{47} = \frac{35}{47};$$

$$\frac{1166}{2067} + \frac{53}{53} = \frac{22}{39}$$

(3) ..
$$\begin{array}{l} 2)15, \ 12, \ 20, \ 18, \ 30 \\ \hline 2)15, \ \ 6, \ 10, \ \ 9, \ 15 \\ \hline 3)15, \ \ 3, \ \ 5, \ \ 9, \ 15 \\ \hline 5) \ 5, \ \ 1, \ \ 5, \ \ 3, \ \ 5 \\ \hline \ \ 1, \ \ 1, \ \ 1, \ \ 3, \ \ 1 \end{array}$$

L.C.D. $= 2 \times 2 \times 3 \times 5 \times 3 = 180$

$\therefore \ \frac{7}{15}, \frac{5}{12}, \frac{13}{20}, \frac{11}{18}, \frac{19}{30} = \frac{84}{180}, \frac{75}{180}, \frac{117}{180}, \frac{110}{180}, \frac{114}{180}$

(4)...
$$1\tfrac{2}{3} \div (\tfrac{5}{12} \text{ of } \tfrac{6}{11})$$

$$\frac{5}{3} \times \frac{\overset{2}{\cancel{12}}}{\cancel{5}} \times \frac{11}{\cancel{6}} = \frac{22}{3} = 7\tfrac{1}{3}$$

(5)...
$$\tfrac{2}{7} : \tfrac{11}{12} :: \overset{\pounds}{300} : x$$

$$x = \frac{7}{2} \times \frac{11}{\cancel{12}} \times \frac{\overset{25}{\cancel{300}}}{1} = \pounds\frac{1925}{2} = \pounds962 \; 10s.$$

(6)...

| cwt. | qr. | lb. | | lb. | | | £ | s. | d. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 1 | 22 | : | 1 | :: | | 5 | 2 | 9 | : | x |
| | 4 | | | | | | | 20 | | | |
| | 9 | | | | | | | 102 | | | |
| | 28 | | | | | | | 12 | | | |
| | 274 | | | | | | | 1233 | | | |

$$x = \frac{1233}{274} = 4\tfrac{1}{2}d. \text{ per lb.}$$

(7)...

| ac. | ro. | per. | yds. |
|---|---|---|---|
| 1 | 3 | 34 | 5½ |
| 4 | | | |
| 7 | | | |
| 40 | | | |
| 314 | | | |
| 30¼ | | | |
| 9425½ | | | |
| 78½ | | | |

$$528)9504(18 \text{ hours}$$
$$528$$
$$\overline{4224}$$
$$4224$$

(8)...

|  |  |  |  | s. | d. |  | £ | s. | d. |
|---|---|---|---|---|---|---|---|---|---|
| 51 yds. Brussels carpeting | | | at | 4 | 9 | = | 12 | 2 | 3 |
| 39 „ Kidderminster „ | | | at | 3 | 3 | = | 6 | 6 | 9 |
| | | difference in expense | | | | = | £5 | 15 | 6 |

(9)...    Cost of 1 qr. of each $= \overset{s.}{66} + \overset{s.}{48} + \overset{s.}{30} = \overset{s.}{144}$

£540 $= 10800s.$

$10800 \div 144 = 75$, quarters of each

(10)...
$$\begin{array}{cccc} \text{men} \ \text{da.} & \text{men} \ \text{da.} & \text{ac.} & \text{ac.} \\ 13 \times 4 & : \quad x \times 2 & :: \quad 32\frac{1}{2} & : \quad 21\frac{1}{4} \\ & & 4 & 4 \\ \hline & & 130 & 85 \end{array}$$

$$x = \frac{13 \times 4 \times 85}{2 \times 130} = 17 \text{ men}$$

## EXERCISE LX.

(1)...

| | £ | s. | d. |
|---|---|---|---|
| 137 guineas ............ = | 143 | 17 | 0 |
| 119 sovereigns......... = | 119 | 0 | 0 |
| 83 half-guineas ...... = | 43 | 11 | 6 |
| 59 half-sovereigns ... = | 29 | 10 | 0 |
| 157 crowns ............ = | 39 | 5 | 0 |
| 225 half-crowns ...... = | 28 | 2 | 6 |
| 97 florins ............ = | 9 | 14 | 0 |
| 353 shillings ......... = | 17 | 13 | 0 |
| | £430 | 13 | 0 |

(2)...    $(89)^2 \times (37)^3 = 89 \times 89 \times 37 \times 37 \times 37$

$= 401222413$

(3)...
$$\begin{array}{r} \overset{\text{grs.}}{24)4245070} \\ 20)176877 \quad 22 \text{ grs.} \\ \overline{12)8843} \quad 17 \text{ dwts.} \\ \overline{736} \quad 11 \text{ oz.} \end{array}$$

*Ans.* 736 lb. 11 oz. 17 dwts. 22 grs.

I

(4)...
$$
\begin{array}{ccc}
\pounds & s. & d. \\
1256 & 13 & 4
\end{array}
\quad : \quad
\begin{array}{c}
s. \\
20
\end{array}
\quad :: \quad
\begin{array}{ccc}
\pounds & s. & d. \\
267 & 0 & 10
\end{array}
\quad : \quad x
$$

$$
\begin{array}{r}
20 \\ \hline
25133 \\
12 \\ \hline
301600
\end{array}
\qquad
\begin{array}{r}
20 \\ \hline
5340 \\
12 \\ \hline
64090
\end{array}
$$

$$
x = \frac{\overset{17}{\cancel{20} \times \cancel{64090}}}{\underset{\underset{4}{\cancel{15080}}}{\cancel{301600}}} = \tfrac{17}{4}s. = 4s.\ 3d.\ \text{in the pound}
$$

(5)...

$$
\begin{array}{lcc}
 & s. & d. \\
2\ \text{Poor rates} & = 3 & 0 \\
\text{Highway rate} & 0 & 6 \\
\text{Church rate} & 0 & 4\tfrac{1}{2} \\ \hline
 & 3 & 10\tfrac{1}{2}\ \text{in the pound} \\
 & \multicolumn{2}{r}{5 \times 11 = 55} \\ \hline
 & 19 & 4\tfrac{1}{2} \\
 & & 11 \\ \hline
\pounds 10 & 13 & 1\tfrac{1}{2}
\end{array}
$$

(6)...

$$
1 - \left(\tfrac{5}{7}\ \text{of}\ \tfrac{14}{15}\ \text{of}\ \tfrac{13}{20}\right)
$$

$$
1 - \left(\frac{\cancel{5}}{7} \times \frac{\overset{2}{\cancel{14}}}{\underset{3}{\cancel{15}}} \times \frac{13}{\underset{10}{\cancel{20}}}\right)
$$

$$
1 - \tfrac{13}{30} = \tfrac{17}{30}
$$

(7)...

$$
2\tfrac{3}{8} + 3\tfrac{5}{9} + 5\tfrac{7}{10} = 10 + \tfrac{3}{8} + \tfrac{5}{9} + \tfrac{7}{10}
$$

$$
= 10 + \frac{135 + 200 + 252}{360}
$$

$$
= 10 + \tfrac{587}{360}
$$

$$
= 10 + 1\tfrac{227}{360}
$$

$$
= 11\tfrac{227}{360}
$$

$$
5\tfrac{11}{18} - 1\tfrac{7}{12} = 5\tfrac{22}{36} - 1\tfrac{21}{36} = 4\tfrac{1}{36}
$$

(8)...

$$\left(\tfrac{5}{9}\text{ of }\tfrac{7}{10}\text{ of }6\tfrac{2}{11}\right)\times\left(\tfrac{9}{28}\text{ of }\tfrac{11}{17}\text{ of }7\tfrac{1}{2}\right)$$

$$=\frac{5}{9}\times\frac{7}{10}\times\frac{68}{11}\times\frac{9}{28}\times\frac{11}{17}\times\frac{15}{2}$$

$$=\tfrac{15}{4}=3\tfrac{3}{4};$$

$$\left(\tfrac{15}{26}\text{ of }\tfrac{13}{18}\text{ of }7\tfrac{1}{2}\right)\div\left(\tfrac{6}{7}\text{ of }\tfrac{5}{8}\text{ of }5\tfrac{3}{5}\right)$$

$$=\frac{15}{26}\times\frac{13}{18}\times\frac{39}{5}\times\frac{7}{6}\times\frac{8}{5}=\frac{5}{28}$$

$$=1$$

(9)...

4s. 8¼d. = 225 farthings
1 sov. = 960 farthings

$$\tfrac{225}{960}=\tfrac{15}{64}\text{ of a sovereign}$$

$$\frac{17}{28}\text{ cwt.}=\frac{17}{28}\times\frac{112}{1}=68\text{ lb.}=2\text{ qrs. }12\text{ lb.}$$

(10)...

$$\frac{4}{7}-\frac{4}{9}=\frac{36-28}{63}=\frac{8}{63}$$

$$\tfrac{8}{63}=32\text{ gallons}$$

$$\tfrac{8}{63}\quad:\quad1\quad::\quad\overset{\text{gal.}}{32}\quad:\quad x$$

$$x=\frac{63}{8}\times\frac{32}{1}=252\text{ gallons}$$

## EXERCISE LXI.

(1)...        $\frac{1302}{1705} \div \frac{31}{31} = \frac{42}{55}; \; \frac{2014}{2021} \div \frac{53}{53} = \frac{38}{67};$

```
1495)2145(1                          65)2795(43
     1495                               260
      650)1495(2                        195
          1300                          195
           195)650(3      ∴ 65 is the G.C.M. required
               585
                65)195(3
                   195
```

G.C.M. of 1495 and 2145 = 65

(2)...    $5\frac{7}{9} + 7\frac{7}{12} + 9\frac{7}{15} = 21 + \frac{7}{9} + \frac{7}{12} + \frac{7}{15}$

$$= 21 + \frac{140 + 105 + 84}{180}$$

$$= 21 + \frac{329}{180}$$

$$= 21 + 1\frac{149}{180}$$

$$= 22\frac{149}{180};$$

$$9\frac{9}{10} - 7\frac{3}{8} = 9\frac{36}{40} - 7\frac{15}{40} = 2\frac{21}{40}$$

(3)...    $(\frac{10}{11}$ of $\frac{15}{16}$ of $2\frac{2}{7}) \times (\frac{7}{8}$ of $\frac{5}{9}$ of $4\frac{2}{5})$

$$= \frac{\overset{5}{\cancel{10}}}{\cancel{11}} \times \frac{\overset{5}{\cancel{15}}}{\cancel{16}} \times \frac{\cancel{16}}{7} \times \frac{7}{\underset{4}{\cancel{8}}} \times \frac{5}{\underset{3}{\cancel{9}}} \times \frac{\overset{2}{\cancel{22}}}{\cancel{5}} = \frac{25}{6} = 4\frac{1}{6};$$

$(\frac{4}{7}$ of $\frac{5}{9}$ of $18) \div (\frac{1}{3}$ of $\frac{10}{11}$ of $2\frac{2}{7})$

$$= \frac{4}{7} \times \frac{5}{9} \times \frac{\overset{2}{\cancel{18}}}{1} \times \frac{3}{1} \times \frac{11}{\underset{2}{\cancel{10}}} \times \frac{7}{\underset{4}{\cancel{16}}} = \frac{33}{4} = 8\frac{1}{4}$$

(4)...
$$14s.\ 10\tfrac{1}{2}d. = 357 \text{ halfpence}$$
$$1 \text{ guinea} = 504 \quad ,,$$
$$\tfrac{357}{504} = \tfrac{17}{24} \text{ of a guinea}$$

$$\frac{39}{64}\text{ sov.} = \frac{39}{\underset{16}{\cancel{64}}}\times\frac{\overset{5}{\cancel{20}}}{1} = \frac{195}{16} = \overset{s.}{12} \ \ \overset{d.}{2\tfrac{1}{4}}$$

(5)...
$$\frac{11}{48}\text{ week} = \frac{11}{\underset{2}{\cancel{48}}}\times\frac{7}{1}\times\frac{\cancel{24}}{1} = \overset{\text{hrs.}}{\frac{77}{2}} = \overset{\text{hrs.}}{38}\ \overset{\text{min.}}{30}$$

$$\frac{29}{36}\text{ day} = \frac{29}{\underset{3}{\cancel{36}}}\times\frac{\overset{2}{\cancel{24}}}{1} = \frac{58}{3} = \underset{\text{hrs.}}{\begin{matrix}19\ 20\\ \overline{19\ 10}\end{matrix}}\text{ min.}$$

(6)...  See "*Answers.*"

(7)...  See "*Answers.*"

```
32)23·00000(·71875
   22 4
   ───
      60
      32
     ───
     280
     256
     ───
     240
     224
     ───
     160
     160
     ───
```

Or thus :—

$$32\left\{\begin{array}{l}4)23\\ \overline{8)5\cdot75000}\\ \quad\ \ \overline{\cdot71875}\end{array}\right.$$

$$\therefore \tfrac{23}{32} = \cdot71875$$

$$80\left\{\begin{array}{l}8)47\\ \overline{10)5\cdot8750}\\ \quad\ \ \overline{\cdot5875}\end{array}\right.$$

$$\therefore \tfrac{47}{80} = \cdot5875$$

$$125\left\{\begin{array}{l}5)69\\ 5)\overline{13\cdot80}\\ 5)\overline{2\cdot760}\\ \quad\ \ \overline{\cdot552}\end{array}\right.$$

$$\therefore \tfrac{69}{125} = \cdot552$$

(8)...   $\cdot 15 = \frac{15}{100} = \frac{3}{20}$; $\cdot 235 = \frac{235}{1000} = \frac{47}{200}$; $\cdot 045 = \frac{45}{1000} = \frac{9}{200}$;

   $\cdot 1875 = \frac{1875}{10000} = \frac{3}{16}$; $\cdot 0036 = \frac{36}{10000} = \frac{9}{2500}$

(9)...    $\cdot 009 \times 10 = \frac{9}{1000} \times 10 = \frac{9}{100} = \cdot 09$,

   $\cdot 009 \times 100 = \frac{9}{1000} \times 100 = \frac{9}{10} = \cdot 9$,

   $\cdot 009 \times 1000 = \frac{9}{1000} \times 1000 = 9$;

   $\cdot 23 \div 10 = \frac{23}{100} \times \frac{1}{10} = \frac{23}{1000} = \cdot 023$,

   $\cdot 23 \div 100 = \frac{23}{100} \times \frac{1}{100} = \frac{23}{10000} = \cdot 0023$,

   $\cdot 23 \div 1000 = \frac{23}{100} \times \frac{1}{1000} = {}_{0}{}^{23} = \cdot 00023$

(10)...   See "*Answers*."

## EXERCISE LXII.

|  | hrs. | min. | hrs. | min. | hrs. | min. |
|---|---|---|---|---|---|---|
| (1)... | From 8 | 6 A.M. to 3 | 51 P.M. = 7 | 45 | | |

   $\phantom{From 8 \ 6 A.M. to 3 \ 51 P.M. = 7 \ }$ 60

   $\phantom{From 8 \ 6 A.M. to 3 \ 51 P.M. = 7 \ }$ $\overline{465}$ minutes

(2)...

lb.

   112

   $2\frac{1}{2}$

   $\overline{224}$

   56

   12)280

   $\overline{\phantom{12}23}$   4 selling price per cwt.

   17   9 cost price per cwt.

   $\overline{\phantom{1}5}$   7 profit on 1 cwt.

   $6\frac{1}{2}$

   $\overline{1\ 13}$   6

   2   $9\frac{1}{2}$

   $\overline{£1\ 16}$   $3\frac{1}{2}$ profit on $6\frac{1}{2}$ cwt.

(3)...
$$7\tfrac{2}{3} \times 6\tfrac{3}{4} \times \tfrac{9}{13} \times \tfrac{4}{5} \times \tfrac{2}{7} \times 1\tfrac{5}{9} \times \tfrac{15}{16} \times \tfrac{8}{9}$$

$$= \frac{\cancel{65}^{5}}{\cancel{9}} \times \frac{\cancel{27}^{3}}{\cancel{4}} \times \frac{9}{\cancel{13}} \times \frac{4}{\cancel{5}} \times \frac{2}{7} \times \frac{\cancel{14}^{2}}{9} \times \frac{\cancel{15}^{3}}{\cancel{16}_{\cancel{2}}} \times \frac{8}{9}$$

$$= 10$$

(4)...
$$\frac{13}{18}\ \text{gui.} = \frac{13}{\cancel{18}} \times \frac{\cancel{252}^{14}}{1} = 182\ \text{pence}$$

$$\pounds 1\ 13s.\ 10d. = 406\ \text{pence}$$

$$\tfrac{182}{406} \div \tfrac{14}{14} = \tfrac{13}{29}$$

(5)...  4 days 16 hours 30 minutes $= 6750$ minutes

1 week $= 10080$ minutes

$$\tfrac{6750}{10080} \div \tfrac{90}{90} = \tfrac{75}{112}\ \text{of a week}$$

(6)...

| | |
|---|---|
| 7·35 | |
| 19·006 | 150 |
| ·525 | 40·32975 |
| ·1075 | 109·67025 |
| 13·34125 | |
| 40·32975 | |

(7)...

```
      726·305      405·26)15168·8818(37·43
       19·216             12157 8
      4357830            301108
       726305            283682
      1452610            174261
      6536745            162104
       726305            121578
   13956·676880          121578
```

(8)...

|   | £ | s. | d. |   |
|---|---|---|---|---|
|   | 5 | 10 | 0 | per cwt. |
|   |   |   |   | 4×4+1 = 17 |
|   | 22 | 0 | 0 |   |
|   |   |   | 4 |   |
|   | 88 | 0 | 0 |   |

| 2 qrs. = ½ of 1 cwt. | 5 | 10 | 0 |
| 14 lb. = ¼ „ 2 qrs. | 2 | 15 | 0 |
| 7 lb. = ½ „ 14 lb. | 0 | 13 | 9 |
| 3½ lb. = ½ „ 7 lb. | 0 | 6 | 10½ |
|  | 0 | 3 | 5¼ |
| £97 | 9 | 0¾ |

|   | £ | s. | d. |   |
|---|---|---|---|---|
|   | 2 | 18 | 0 | per quarter |
|   |   |   |   | 4×7+1 = 29 |
|   | 11 | 12 | 0 |   |
|   |   |   | 7 |   |
|   | 81 | 4 | 0 |   |

| 4 bu. = ½ of 1 qr. | 2 | 18 | 0 |
| 2 bu. = ½ „ 4 bu. | 1 | 9 | 0 |
| 1 bu. = ½ „ 2 bu. | 0 | 14 | 6 |
| 1 pk. = ¼ „ 1 bu. | 0 | 7 | 3 |
|  | 0 | 1 | 9¾ |
| £86 | 14 | 6¾ |

|   |   | £ | s. | d. |   |
|---|---|---|---|---|---|
| 84 gui. = | 88 | 4 | 0 | per acre |
|   |   |   | 4×4+1 = 17 |
|   | 352 | 16 | 0 |   |
|   |   |   | 4 |   |
|   | 1411 | 4 | 0 |   |

| 2 ro. = ½ of 1 ac. | 88 | 4 | 0 |
| 1 ro. = ½ „ 2 ro. | 44 | 2 | 0 |
| 20 per. = ½ „ 1 ro. | 22 | 1 | 0 |
| 2½ per. = ⅛ „ 20 per. | 11 | 0 | 6 |
|  | 1 | 7 | 6¾ |
| £1577 | 19 | 0¾ |

$$(9)\ldots \quad \overset{\text{per. da.}}{5\times 8} \ : \ \overset{\text{per. da.}}{6\times x} \ :: \ \overset{\text{gal.}}{7\tfrac{1}{2}} \ : \ \overset{\text{bar. gal.}}{2} = 72$$

$$\begin{array}{cc} \phantom{xxxxxxxxxxxx} & 2 \\ \hline & \overline{15} \end{array} \qquad \begin{array}{c} 2 \\ \hline \overline{144} \end{array}$$

$$x = \frac{\cancel{5}\times 8\times \overset{\overset{8}{\cancel{24}}}{\cancel{144}}}{\cancel{6}\times \cancel{15}} = 64 \text{ days}$$

$$(10)\ldots$$

<div style="text-align:center">

                  min. sec.

one gains 4   35 in 24 hours

the other loses 3   45 in 24 hours

∴ there is a difference of $\overline{8\quad 20}$ in 24 hours

</div>

From Saturday, 6 P.M. to Tuesday, noon = 66 hours

$$\begin{array}{ccccc} \overset{\text{hrs.}}{\cancel{24}} & : & \overset{\text{hrs.}}{\cancel{66}} & :: & \overset{\text{min. sec.}}{8\quad 20} \\ 4 & & 11 & & 11 \\ & & & & \overline{4)91\quad 40} \\ & & & & \text{min. } 22\quad 55 \text{ sec.} \end{array}$$

### EXERCISE LXIII.

$$(1)\ldots \quad \overset{\text{hrs. min.}}{\text{From 3 44}} \text{ A.M. to } \overset{\text{hrs. min.}}{\text{8 18}} \text{ P.M.} = \overset{\text{hrs. min.}}{16\ 34}$$

$$\begin{array}{c} 60 \\ \hline 994 \text{ minutes} \end{array}$$

$$(2)\ldots \qquad 4000 \text{ tons} = 80,000 \text{ cwt.}$$

$$\begin{array}{l} \overset{s.\quad d.}{10\ \ 0} = \tfrac{1}{2} \text{ of £1} \\ \phantom{10\ \ }6 = \tfrac{1}{20} \text{ ,, } 10s. \\ \phantom{10\ \ }3 = \tfrac{1}{2} \text{ ,, } 6d. \end{array} \begin{array}{|l} \overset{£}{80000} = \text{value at £1 per cwt.} \\ 40000 \\ 2000 \\ 1000 \\ \hline £43000 \end{array}$$

(3)...
$$357)425(1$$
$$357$$
$$\overline{68})357(5 \qquad \text{G.C.M.} = 17$$
$$340$$
$$\overline{17})68(4$$
$$68$$

$$391)667(1 \qquad\qquad 23)713(31$$
$$391 \qquad\qquad\qquad 69$$
$$\overline{276})391(1 \qquad\qquad \overline{23}$$
$$276 \qquad\qquad\qquad 23$$
$$\overline{115})276(2$$
$$230 \qquad \text{G.C.M. required 23}$$
$$\overline{46})115(2$$
$$92$$
$$\overline{23})46(2$$
$$46$$

G.C.M. of 391 and 667 = 23

(4)...
$$
\begin{array}{r}
2)3\ \ 7\ \ 9\ \ 14\ \ 15\ \ 36\ \ 63 \\
\hline
3)3\ \ 7\ \ 9\ \ \ \ 7\ \ 15\ \ 18\ \ 63 \\
\hline
3)1\ \ 7\ \ 3\ \ \ \ 7\ \ \ \ 5\ \ \ \ 6\ \ 21 \\
\hline
7)1\ \ 7\ \ 1\ \ \ \ 7\ \ \ \ 5\ \ \ \ 2\ \ \ \ 7 \\
\hline
1\ \ 1\ \ 1\ \ \ \ 1\ \ \ \ 5\ \ \ \ 2\ \ \ \ 1
\end{array}
$$

L.C.M. = $2 \times 3 \times 3 \times 7 \times 5 \times 2 = 1260$

(5)...
$$1\tfrac{3}{5}+2\tfrac{4}{9}+3\tfrac{5}{7} = 6+\tfrac{3}{5}+\tfrac{4}{9}+\tfrac{5}{7}$$
$$= 6+\frac{189+140+225}{315}$$
$$= 6+1\tfrac{239}{315}$$
$$= 7\tfrac{239}{315};$$
$$7\tfrac{2}{9}-3\tfrac{7}{12} = 7\tfrac{8}{36}-3\tfrac{21}{36} = 3\tfrac{23}{36}$$

(6)...
$$\frac{5}{12} \times 3\tfrac{3}{4} \times 7 \times 2\tfrac{2}{15} = \frac{5}{\cancel{12}_3} \times \frac{\cancel{15}}{\cancel{4}} \times \frac{7}{1} \times \frac{\cancel{32}^{\;\overset{2}{\cancel{8}}}}{\cancel{15}}$$

$$= \tfrac{70}{3} = 23\tfrac{1}{3};$$

$$5\tfrac{7}{16} \div 3\tfrac{5}{8} = \frac{\cancel{87}^{3}}{\cancel{16}_2} \times \frac{\cancel{8}}{\cancel{29}} = \frac{3}{2} = 1\tfrac{1}{2}$$

(7)...
11s. 10½d. = 285 halfpence
1 sovereign = 480    ,,

$\tfrac{285}{480} \div \tfrac{15}{15} = \tfrac{19}{32}$ of a sovereign

9s. 7½d. = 231 halfpence
1 guinea = 504 halfpence

$\tfrac{231}{504} \div \tfrac{21}{21} = \tfrac{11}{24}$ of a guinea

(8)...
$$\frac{11}{24}\text{ gui.} = \frac{11}{\cancel{24}_8} \times \frac{\cancel{21}^{7}}{1} = \frac{77}{8} = \overset{£\quad s.\quad d.}{0\quad 9\quad 7\tfrac{1}{2}}$$

$$\frac{19}{32}\text{ sov.} = \frac{19}{\cancel{32}_8} \times \frac{\cancel{20}^{5}}{1} = \frac{95}{8} = 0\quad 11\quad 10\tfrac{1}{2}$$

$$\frac{17}{24}\text{ cro.} = \frac{17}{24} \times \frac{5}{1} = \frac{85}{24} = 0\quad 3\quad 6\tfrac{1}{2}$$

$$\frac{11}{16}s. = \frac{11}{\cancel{16}_4} \times \frac{\cancel{12}^{3}}{1}d. = \frac{33}{4}d. = 0\quad 0\quad 8\tfrac{1}{4}$$

$$\overline{£1\quad 5\quad 8\tfrac{3}{4}}$$

(9)...

| | s. | d. | £ | s. | d. |
|---|---|---|---|---|---|
| 3½ yds. Longcloth ......... | 1 | 1 = | 0 | 3 | 9½ |
| ⅜ yd. Irish Linen ......... | 3 | 6 = | 0 | 1 | 3¾ |
| 8 Buttons ..................... | | = | 0 | 0 | 4 |
| Making ........................ | | = | 0 | 2 | 9 |
| Cost of each shirt ......... | | = | 0 | 8 | 2¼ |
| | | | | | 12 |
| Cost of a dozen shirts ... | | = | £4 | 18 | 3 |

(10)...   1 woman can do $\frac{7}{10}$ of the work of a man

$\therefore$ 5 women can do $(\frac{7}{10} \times 5 = )$ $3\frac{1}{2}$ times the work of a man

$$
\begin{array}{cccc}
 & & & \text{da.} \\
7+3\tfrac{1}{2} = 1\cancel{0}\tfrac{1}{2} & : & 7 & :: & 15 \\
\phantom{7+3\tfrac{1}{2} = }3 & & 2 & & 2 \\
\end{array}
$$

$$3)\overline{30}$$
$$\overline{10}\ \text{days}$$


## EXERCISE LXIV.

$$
\begin{array}{lllll}
 & & & £ & s. & d. \\
(1)\ldots\ \ \text{\scriptsize a} & 217\ \text{half-guineas} & = & 113 & 18 & 6 \\
 & 149\ \text{half-crowns} & = & 18 & 12 & 6 \\
 & 437\ \text{sixpences} & = & 10 & 18 & 6 \\
 & 519\ \text{halfpence} & = & 1 & 1 & 7\tfrac{1}{2} \\
\end{array}
$$

$$£\overline{144\ \ 11\ \ \ 1\tfrac{1}{2}}$$

(2)...   £1167   3s.   $1\frac{1}{4}d.$ = 1120469 farthings

£19   15s.   $7\frac{3}{4}d.$ = 18991 farthings

$1120469 \div 18991 = 59$

(3)...                3 yds.  3 qrs.  2 na. = 62 nails

$34\frac{1}{2}$ yds.$+43\frac{3}{4}$ yds.$+61\frac{1}{4}$ yds. $= 139\frac{1}{2}$ yds. = 2232 nails

$2232 \div 62 = 36$ suits

$$
\begin{array}{llllllll}
 & & & s. & d. & £ & s. & d. \\
(4)\ldots & 17\tfrac{3}{4}\ \text{yds. Silk Velvet} & \ldots\ldots 7 & 6 = & 6 & 13 & 1\tfrac{1}{2} \\
 & 29\tfrac{1}{4}\ \ \text{„}\ \ \ \text{Lutestring} & \ldots\ldots 3 & 9 = & 5 & 9 & 8\tfrac{1}{4} \\
 & 19\tfrac{1}{2}\ \ \text{„}\ \ \ \text{Flannel} & \ldots\ldots 1 & 5 = & 1 & 7 & 7\tfrac{1}{2} \\
 & 26\tfrac{1}{4}\ \ \text{„}\ \ \ \text{Irish Linen} & \ldots\ldots 1 & 8 = & 2 & 3 & 9 \\
\end{array}
$$

$$£\overline{15\ \ 14\ \ \ 2\tfrac{1}{4}}$$

(5)...   $\dfrac{\frac{4}{9}}{\frac{7}{8}} = \dfrac{4\times 8}{7\times 9} = \dfrac{32}{63}$; $\dfrac{2\frac{3}{5}}{7} = \dfrac{\frac{13}{5}}{\frac{7}{1}} = \dfrac{13}{7\times 5} = \dfrac{13}{35}$

$$\dfrac{5}{8\frac{4}{5}} = \dfrac{\frac{5}{1}}{\frac{44}{5}} = \dfrac{5\times 5}{44} = \dfrac{25}{44};$$

$$\dfrac{4\frac{7}{10}}{8\frac{5}{12}} = \dfrac{\frac{47}{10}}{\frac{101}{12}} = \dfrac{47\times 12}{101\times 10} = \dfrac{564}{1010} = \dfrac{282}{505}$$

(6)...
$$40 \begin{cases} 10)29 \\ 4)\overline{\ 2\cdot 9} \\ \hline \qquad \cdot 725 \end{cases}$$

$$50 \begin{cases} 10)37 \\ 5)\overline{\ 3\cdot 7} \\ \hline \qquad \cdot 74 \end{cases}$$

$$80 \begin{cases} 10)61 \\ 8)\overline{\ 6\cdot 1} \\ \hline \qquad \cdot 7625 \end{cases}$$

$$250 \begin{cases} 10)137 \\ 5)\overline{\ 13\cdot 7} \\ 5)\overline{\ 2\cdot 74} \\ \hline \qquad \cdot 548 \end{cases}$$

(7)...
```
·076)6·08380(80·05
     6 08
     ───
        380
        380
        ───
```
```
·0075)·94125(125·5
       75
       ──
       191
       150
       ───
       412
       375
       ───
        375
        375
```

(8)...
```
      4) 2
     12) 7·5
     20)14·625
```
14s. 7½d. = ·73125 of sov.

```
      gui.
    ·5625 = 11s 9¾d.
      21
    ───────
    11·8125s.
      12
    ───────
    9·7500d.
       4
    ───────
    3·0000 far.
```

(9)...

| E. ells | | yds. | | £ | s. | | |
|---|---|---|---|---|---|---|---|
| 8⅘ | : | 19¾ | :: | 1 | 2 | : | $x$ |
| 5 | | 4 | | 20 | | | |
| 44 | | 79 | | 22 | | | |

$$x = \frac{79 \times 22}{44} = \frac{79}{2}s. = £1 \ 19s. \ 6d.$$

(10)...    $\frac{3}{4}$ peck $\times 365 = 273\frac{3}{4}$ pecks

      1 quarter $= 32$ pecks

$$
\begin{array}{ccccccc}
\text{pks.} & & \text{pks.} & & s. & & \\
32 & : & 273\frac{3}{4} & :: & 32 & : & x \\
4 & & 4 & & & & \\
\hline
128 & & 1095 & & & &
\end{array}
$$

$$x = \frac{1095 \times \cancel{32}}{\cancel{128}_{\,4}} = \frac{1095}{4} = \pounds 13 \; 13s. \; 9d.$$

    $\frac{1}{3}$ truss $\times 365 = 121\frac{2}{3}$ trusses

$$
\begin{array}{ccccccc}
\text{tr.} & & \text{tr.} & & \pounds & s. & \\
36 & : & 121\frac{2}{3} & :: & 4 & 4 & : \quad x \\
3 & & 3 & & 20 & & \\
\hline
108 & & 365 & & 84 & &
\end{array}
$$

$$x = \frac{365 \times \overset{7}{\cancel{84}}}{\underset{9}{\cancel{108}}} = \frac{2555}{9}s. = \pounds 14 \; 3s. \; 10\frac{2}{3}d.$$

$$
\begin{array}{lccc}
 & \pounds & s. & d. \\
\text{Cost of oats} & 13 & 13 & 9 \\
\text{,,\quad hay} & 14 & 3 & 10\frac{2}{3} \\
\hline
 & \pounds 27 & 17 & 7\frac{2}{3}
\end{array}
$$

## EXERCISE LXV.

(1)...

| | sq. yds. | sq. ft. | sq. in. |
|---|---|---|---|
| | 29 | 6 | 117 |
| | 34 | 8 | 93 |
| | 17 | 5 | 123 |
| | 55 | 7 | 79 |
| | 138 | 1 | 124 |

(2)...

                    sq. yds                          *Proof.*
                    596347
                         4                      ac.   po.   yds.
yds.    qrs. ⎧ 11)$\overline{2385388}$          123   33    28$\frac{3}{4}$
30$\frac{1}{4}$=121 ⎨   11)$\overline{216853}$  5 ⎫ qrs.  yds.        4
        ⎩   40)$\overline{19713}$  10 ⎬ 115=28$\frac{3}{4}$   $\overline{492}$
                                                              40
                  4)$\overline{492\ 33}$ poles        $\overline{19713}$
                    $\overline{123}$ acres            30$\frac{1}{4}$
                                                  $\overline{591418\frac{3}{4}}$
*Ans.* 123 ac. 33 po. 28$\frac{3}{4}$ sq. yds.        4928$\frac{1}{4}$
                                                  $\overline{596347}$ sq. yds.

                              d.    £   s.   d.
(3)...        71$\frac{3}{4}$ lb. Coffee at 16 = 4   15   8
                          cost = 3   18   9
          .               profit = $\overline{16\ \ 11}$

         yds.        yds.        £   s.   d.
(4)...   17$\frac{3}{4}$  :  19$\frac{1}{2}$  ::  9   3   5   :   $x$
          4           4           20
         $\overline{71}$       $\overline{78}$       $\overline{183}$
                                   12
                              $\overline{2201}$

                         31
$x = \dfrac{78 \times \cancel{2201}}{\cancel{71}} = 2418d. = £10\ 1s.\ 6d.$

         yds.        yds.        d.
         17$\frac{3}{4}$  :  23$\frac{1}{4}$  ::  2201   :   $x$
          4           4
         $\overline{71}$       $\overline{93}$
                         31
$x = \dfrac{93 \times \cancel{2201}}{\cancel{71}} = 2883d. = £12\ 0s.\ 3d.$

(5)...

  1.  $\dfrac{4\frac{3}{4}+5\frac{2}{9}}{7\frac{5}{8}-3\frac{7}{8}} = \dfrac{4\frac{27}{36}+5\frac{8}{36}}{7\frac{20}{24}-3\frac{21}{24}} = \dfrac{9\frac{35}{36}}{3\frac{23}{24}} = \dfrac{359}{36} \div \dfrac{95}{24}$

                     2
      $= \dfrac{359 \times \cancel{24}}{94 \times \cancel{36}} = \dfrac{718}{285} = 2\frac{148}{285};$
                     3

2. $\dfrac{8\frac{4}{5}+3\frac{3}{10}}{5\frac{1}{4}\times 2\frac{2}{7}} = \dfrac{\frac{44}{5}\times\frac{10}{33}}{\frac{21}{4}\wedge\frac{16}{7}} = \dfrac{\frac{8}{3}}{12} = \dfrac{8}{36} = \dfrac{2}{9}$ ;

8. $\dfrac{10\frac{2}{3}-5\frac{3}{8}}{1\frac{1}{4}\text{ of }6\frac{1}{4}} = \dfrac{10\frac{16}{38}-5\frac{21}{38}}{1\frac{1}{4}\times\frac{25}{4}} = \dfrac{4\frac{51}{38}}{\frac{275}{38}} = \dfrac{275}{275} = 1$

(6)...    13 cwt. 2 qrs. 21 lb. = 1533 lb.
              1 ton = 2240 lb.

$\frac{1533}{2240}\div 7 = \frac{219}{320}$ of a ton

1 qr. 24½ lb. = 105 half-pounds
          1 cwt = 224        ,,

$\frac{105}{224}\div 7 = \frac{15}{32}$ of a cwt.

(7)...    $\cdot 1875 = \frac{1875}{10000} = \frac{3}{16}$ ;   $\cdot 096 = \frac{96}{1000} = \frac{12}{125}$

(8)...    $\dfrac{5}{16}+\dfrac{2}{15} = \dfrac{75+32}{240} = \dfrac{107}{240}$

$$\frac{1}{12} \; : \; \frac{107}{240} \; :: \; \overset{s.}{10} \; : \; x$$

$x = \dfrac{12}{1}\times\dfrac{107}{240}\times\dfrac{10}{1} = \dfrac{107}{2}s. = \pounds 2 \; 13s. \; 6d.$

(9)...
| men da. hrs. | | men da. hrs. | | £ s. | | £ |
|---|---|---|---|---|---|---|
| $8\times 7\times 10\frac{1}{2}$ | : | $10\times x\times 9$ | :: | 14 14 | : | 27 |
| 2 | | 2 | | 20 | | 20 |
| 21 | | 18 | | 294 | | 540 |

$x = \dfrac{8\times 7\times 21\times 540}{10\times 18\times 294} = 12$ days

(10)...At the end of 1 hour, they are $6\frac{3}{4}+7\frac{1}{2} = 14\frac{1}{4}$ nearer to each other than at the commencement:

∴ they will meet in $(70\div14\frac{1}{4} = \frac{70}{1}\times\frac{4}{57} = \frac{280}{57} =)4\frac{52}{57}$ hours

A will have travelled $(6\frac{3}{4}\times4\frac{52}{57}=\frac{27}{4}\times\frac{280}{57} = \frac{630}{19}=)33\frac{3}{19}$ miles

B    ,,     ,,     $(7\frac{1}{2}\times4\frac{52}{57}=\frac{15}{2}\times\frac{280}{57} = \frac{700}{19}=)36\frac{16}{19}$ miles

### EXERCISE LXVI.

(1)...

|  |  | s. d. | £ s. d. |
|---|---|---|---|
| $17\frac{1}{2}$ lb. | Black tea.........4 | 4 = | 3 15 10 |
| $2\frac{3}{4}$ ,, | Green tea ......5 | 4 = | 14 8 |
| $8\frac{1}{2}$ ,, | Coffee ............1 | 8 = | 14 2 |
| $4\frac{1}{2}$ ,, | Cocoa ............1 | 6 = | 6 9 |
| 21 ,, | Raw sugar ...... | $4\frac{1}{2}$ = | 7 $10\frac{1}{2}$ |
| 15 ,, | Refined sugar ... | $6\frac{1}{2}$ = | 8 $1\frac{1}{2}$ |
|  |  |  | £6 7 5 |

(2)...

$$1 \text{ acre} = 4840 \text{ sq. yds.}$$
$$15\frac{3}{4}$$
$$\overline{24200}$$
$$4840$$
$$3630$$
$$\text{yds.}$$
$$\frac{1}{4} \text{ mile} = 440)\overline{76230}(173\frac{1}{4} \text{ yards}$$
$$440$$
$$\overline{3223}$$
$$3080$$
$$\overline{1430}$$
$$1320$$
$$\overline{110} = \frac{1}{4}$$
$$\frac{110}{440}$$

(3)...

$$\begin{array}{ccccc} \text{hrs.} & & \text{hrs.} & & \text{da.} \\ 8\frac{1}{2} & : & 13 & :: & 5\frac{1}{2} & : & x \end{array}$$

$$x = \frac{2}{17}\times\frac{13}{1}\times\frac{11}{2} = \frac{143}{17} \text{ da.} = 8\frac{7}{17} \text{ da.} = 8 \text{ da. } 3\frac{1}{2} \text{ hrs.}$$

K

(4)...  $8\frac{11}{15} - 5\frac{4}{5} = 8\frac{33}{45} - 5\frac{20}{45} = 3\frac{13}{45}$;

$$15\frac{5}{9} \div 5\frac{3}{5} = \frac{\cancel{140}^{5}}{9} \times \frac{5}{\cancel{28}} = \frac{25}{9} = 2\frac{7}{9}$$

(5)...  $1\frac{1}{8}, \frac{17}{25}, 3\frac{1}{2} = \frac{1400}{1200}, \frac{4800}{1200}, \frac{4725}{1200}$

$\frac{4800}{1200}$, corresponding to $\frac{17}{25}$, is the greatest

(6)...  $$\frac{13\frac{3}{4}}{24\frac{3}{4}} = \frac{\frac{55}{4}}{\frac{99}{4}} = \frac{55}{99} = \frac{5}{9}$$

$$\begin{array}{r} £\quad s.\quad d. \\ 9)\overline{7\quad 15\quad 3} \\ \hline 17\quad 3 \\ 5 \\ \hline £4\quad 6\quad 3 \end{array}$$

(7)...  19 weeks, 4 days, 12 hours = 3300 hours

365 days,  6 hours = 8766 hours

$\frac{3300}{8766} \div \frac{6}{6} = \frac{550}{1461}$

(8)...  1.  $(19\cdot205 - 7\cdot65) + \cdot3125$
  $= 11\cdot555 + \cdot3125$
  $= 36\cdot976$

2.  $(26\cdot5 \times 6\cdot75 \times \cdot025) + 1\cdot875$
  $= 4\cdot471875 \div 1\cdot875$
  $= 2\cdot385$

3.  $(1\cdot375 \div \cdot0625) \times (16\cdot3 - 11\cdot65)$
  $= 22 \times 4\cdot65$
  $= 102\cdot3$

(9)...
$$\begin{array}{l} 4)\ 3 \\ 12)\ \overline{0\cdot75} \\ 21)\overline{17\cdot0625} \\ \end{array}$$

$17s.\ 0\frac{3}{4}d. = \overline{\cdot8125}$ of a gui.

cwt.

$\cdot265625 = 1$ qr. 1 lb. 12 oz.

$$\begin{array}{r} \cdot265625 \\ 4 \\ \hline \text{qr. } 1\cdot062500 \\ 28 \\ \hline \text{lb. } 1\cdot750000 \\ 16 \\ \hline \text{oz. } 12\cdot000000 \end{array}$$

(10)...

$$\begin{array}{ccccccc} \text{yds.} & & \text{yds.} & & \text{£} & & \\ 13\cdot6875 & : & 47\cdot025 & :: & 9\cdot125 & : & x \end{array}$$

$$x = \frac{47\cdot025 \times 9\cdot125}{13\cdot6875} = £31\cdot35 = £31 \ 7s.$$

*EXERCISE LXVII.*

(1)...

$$\begin{array}{r} \text{lb.} \\ 1505280 \\ 16 \end{array}$$

9797760)24084480(2 oz. $7\frac{4+1}{30}$ drs.
      19595520
       4488960
            16
9797760)71823360(7 drs.
      68584320
       3239040   241
       ——————— = ———
       9797760   729

(2)...

$$\begin{array}{ll} \text{lb.} & \text{lb.} \\ 15\frac{1}{4} & 68\frac{1}{2} \\ 14\frac{2}{3} & \underline{6\frac{1}{2}} \text{ per lb.} \\ 13\frac{1}{2} & 411 \\ 13 & 34\frac{1}{4} \\ 12 & 12)445\frac{1}{4} \\ \overline{68\frac{1}{2}} & 20)37 \quad 1\frac{1}{4} \\ & £1 \ 17s. \ 1\frac{1}{4}d. \end{array}$$

(3)...

| s. | d. | | £ | s. | d. | |
|----|----|----|----|----|----|----|
| 10 | 0 | $= \frac{1}{2}$ of £1 | 737 | 0 | 0 | = value at £1 per yd. |
| 1 | 3 | $= \frac{1}{8}$ of 10s. | 368 | 10 | 0 | |
| | 6 | $= \frac{1}{20}$ of 10s. | 46 | 1 | 3 | |
| | $\frac{3}{4}$ | $= \frac{1}{8}$ of 6d. | 18 | 8 | 6 | |
| | | | 2 | 6 | $0\frac{3}{4}$ | |
| | | | £435 | 5 | $9\frac{3}{4}$ | |

x 2

$$\begin{array}{ll}
2 \text{ qrs.} = \tfrac{1}{2} \text{ of } 1 \text{ cwt.} &
\begin{array}{rrr}
£ & s. & d. \\
7 & 10 & 0 \quad \text{per cwt.} \\
& & 7 \\
\hline
52 & 10 & 0 \\
\end{array}
\end{array}$$

14 lb. $= \tfrac{1}{4}$ of 2 qrs.   3 15   0
3½ lb. $= \tfrac{1}{4}$ of 14 lb.   0 18   9
    0   4   8¼
£57   8   5¼

$$\begin{array}{ll}
2 \text{ bu.} = \tfrac{1}{4} \text{ of } 1 \text{ qr.} &
\begin{array}{rrr}
£ & s. & d. \\
1 & 6 & 0 \quad \text{per quarter} \\
& & 5 \\
\hline
6 & 10 & 0 \\
\end{array}
\end{array}$$

1 bu. $= \tfrac{1}{3}$ of 2 bu.   0   6   6
2 pks. $= \tfrac{1}{2}$ of 1 bu.   0   3   3
    0   1   7½
£7   1   4½

(4)...  

$$7)\overline{16 \quad 7\tfrac{1}{2}} \qquad 9)\overline{1 \quad 10 \quad 11\tfrac{1}{4}} \qquad 12)\overline{3 \quad 8 \quad 9}$$

$$\begin{array}{c} 2 \quad 4\tfrac{1}{2} \\ 5 \\ \hline 11s. \ 10\tfrac{1}{2}d. \end{array} \qquad \begin{array}{c} 3 \quad 5\tfrac{1}{4} \\ 2 \\ \hline 6s. \ 10\tfrac{1}{2}d. \end{array} \qquad \begin{array}{c} 5 \quad 8\tfrac{2}{3} \\ 7 \\ \hline £2 \quad 0 \quad 1\tfrac{1}{4} \end{array}$$

$$\begin{array}{rrrrl}
& £ & s. & d. & \\
\tfrac{5}{7} \text{ of } 0 & 16 & 7\tfrac{1}{2} & = 0 & 11 \quad 10\tfrac{1}{2} \\
\tfrac{2}{3} \text{ of } 1 & 10 & 11\tfrac{1}{4} & = 0 & 6 \quad 10\tfrac{1}{2} \\
\tfrac{7}{12} \text{ of } 3 & 8 & 9 & = 2 & 0 \quad 1\tfrac{1}{4} \\
\hline
& & & £2 & 18 \quad 10\tfrac{1}{4}
\end{array}$$

(5)...  

5 oz. 17 dwts. 18 grs. $= 2826$ grains
1 lb. $= 5760$ grains

$$\tfrac{2826}{5760} \div \tfrac{18}{18} = \tfrac{157}{320} \text{ of a lb. Troy}$$

(6)...  

A can reap $\tfrac{2}{21}$ of an acre in 1 hour
B  ,,   $\tfrac{1}{12}$  ,,  ,,
C  ,,   $\tfrac{2}{27}$  ,,  ,,

$\therefore$ A+B+C can reap $\left(\tfrac{2}{21} + \tfrac{1}{12} + \tfrac{2}{27}\right)$ acre in 1 hour

$$\frac{2}{21} + \frac{1}{12} + \frac{2}{27} = \frac{72 + 63 + 56}{756} = \frac{191}{756}$$

$$\begin{array}{cccc} \text{ac.} & \text{ac.} & \text{hr.} & \\ \tfrac{191}{756} \;:\; & 5 \;::\; & 1 \;:\; & x \end{array}$$

$$x = \tfrac{756}{191} \times \tfrac{5}{1} = \tfrac{3780}{191} = 19\tfrac{181}{191}\ \text{hours}$$

(7)...  

1. $\quad 271 \;:\; 383 \;::\; 3523 \;:\; x$

$$x = \frac{383 \times \overset{13}{\cancel{3523}}}{\cancel{271}} = 4979$$

2. $\quad 64\tfrac{5}{8} \;:\; 26\tfrac{8}{9} \;::\; 5\tfrac{7}{8} \;:\; x$

$$x = \frac{\cancel{8}}{\underset{11}{\cancel{517}}} \times \frac{\overset{22}{\cancel{242}}}{9} \times \frac{47}{\cancel{8}} = \frac{22}{9} = 2\tfrac{4}{9}$$

3. $\quad 2{\cdot}035 \;:\; 7{\cdot}613 \;::\; 34{\cdot}595 \;:\; x$

$$x = \frac{7{\cdot}613 \times \overset{17}{\cancel{34{\cdot}595}}}{\cancel{2{\cdot}035}} = 129{\cdot}421$$

(8)...  

1 hf. cr. + 2 fl. + 3s. = 9s. 6d. = 19 sixpences  
19 guineas = 798 sixpences  
$798 \div 19 = 42$  

$\qquad\qquad\qquad$ 42 half-crowns  
$42 \times 2 = 84$ florins  
$42 \times 3 = 126$ shillings  

(9)...  

$$\begin{array}{cccccc} \text{hrs. da.} & & \text{hrs. da.} & & \pounds\ \ s.\ \ d. & \\ 5\times49 \;:\; & & 11\times25 \;::\; & & 18\ \ 7\ \ 6 \;:\; & x \\ & & & & 8 & \\ & & & & \overline{147}\ \text{hf. cr.} & \end{array}$$

$$x = \frac{11 \times \overset{5}{\cancel{25}} \times \overset{3}{\cancel{147}}}{\cancel{5} \times \cancel{49}} = 165\ \text{hf. cr.} = \pounds20\ \ 12s.\ \ 6d.$$

<center>cattle mo.</center>

(10)...                A   $25 \times 5 = 125$
                       B   $35 \times 3 = 105$
                       C   $45 \times 6 = \underline{270}$
                                          $\overline{500}$

<div>

$$500 : 125 :: \overset{£ \quad s.}{12 \; 10} : \overset{£ \quad s. \quad d.}{3 \quad 2 \quad 6} \; A$$

$$500 : 105 :: \overset{£ \quad s.}{12 \; 10} : \overset{£ \quad s. \quad d.}{2 \; 12 \; 6} \; B$$

$$500 : 270 :: \overset{£ \quad s.}{12 \; 10} : \overset{£ \quad s. \quad d.}{6 \; 15 \; 0} \; C$$

</div>

## EXERCISE LXVIII.

(1)...   See "*Answers.*"

(2)...
```
      333)414(1          9)711(79
      333               63
      ‾‾‾               ‾‾
       81)333(4          81
       324               81
       ‾‾‾‾
        9)81(9        G.C.M. required = 9
          81
```
G.C.M. of 333 and 414 = 9

```
2)7   9  16  21  42  56  63
2)7   9   8  21  21  28  63
2)7   9   4  21  21  14  63
3)7   9   2  21  21   7  63
3)7   3   2   7   7   7  21
7)7   1   2   7   7   7   7
  1   1   2   1   1   1   1
```

L.C.M. $= 2 \times 2 \times 2 \times 3 \times 3 \times 7 \times 2 = 1008$

(3)...

$$3\tfrac{4}{7}+2\tfrac{2}{5}+5\tfrac{1}{4} = 10+\tfrac{4}{7}+\tfrac{2}{5}+\tfrac{1}{4}$$
$$= 10+\frac{80+56+35}{140}$$
$$= 10+\tfrac{171}{140}$$
$$= 10+1\tfrac{31}{140} = 11\tfrac{31}{140}$$

$$2\tfrac{7}{10}+6\tfrac{1}{2}+7\tfrac{3}{14} = 15+\tfrac{7}{10}+\tfrac{1}{2}+\tfrac{3}{14}$$
$$= 15+\frac{49+35+15}{70}$$
$$= 15+\tfrac{99}{70}$$
$$= 15+1\tfrac{29}{70} = 16\tfrac{29}{70}$$

$$16\tfrac{29}{70}-11\tfrac{31}{140} = 16\tfrac{58}{140}-11\tfrac{31}{140} = 5\tfrac{27}{140}$$

(4)...

$$\frac{2\tfrac{1}{5}}{7\tfrac{1}{3}} = \frac{\tfrac{11}{5}}{\tfrac{22}{3}} = \frac{11\times3}{22\times5} = \frac{3}{10}$$

$$3\tfrac{1}{4}\times\frac{8}{9}\times6\tfrac{2}{13}\times\frac{3}{16}\times\frac{2\tfrac{1}{5}}{7\tfrac{1}{3}}$$

$$= \frac{13}{4}\times\frac{8}{9}\times\frac{80}{13}\times\frac{3}{16}\times\frac{3}{10}=1$$

(5)...

$$\frac{11}{14}\text{ gui.} = \frac{11}{14}\times\frac{21}{1} = \frac{33}{2} = \begin{array}{ccc}\pounds & s. & d. \\ 0 & 16 & 6\end{array}$$

$$\frac{7}{15}\text{ sov.} = \frac{7}{15}\times\frac{20}{1} = \frac{28}{3} = 0\quad 9\quad 4$$

$$\frac{13}{16}\text{ flo.} = \frac{13}{16}\times\frac{2}{1} = \frac{13}{8} = 0\quad 1\quad 7\tfrac{1}{2}$$
$$\pounds1\quad 7\quad 5\tfrac{1}{2}$$

$(6)...\overset{\text{gui.}}{\cdot 5625} = 11s.\ 9\tfrac{3}{4}d.$

$$\frac{21}{11\cdot 8125s.}$$

$$\frac{12}{9\cdot 7500d.}$$

$$\frac{4}{3\cdot 0000f.}$$

$\dfrac{17}{24}$ sov. $= \dfrac{17}{\cancel{24}}\times\dfrac{\overset{5}{\cancel{20}}}{1} = \dfrac{85}{6}s. = 14s.\ 2d.$

$14s.\ 2d.-11s.\ 9\tfrac{3}{4}d. = 2s.\ 4\tfrac{1}{4}d.$

|  |  |  | s. | d. | £ | s. | d. |
|---|---|---|---|---|---|---|---|
| (7)... | 12 doz. | Port .................. | 54 | 0 = | 32 | 8 | 0 |
|  | 15 „ | Sherry ............... | 45 | 0 = | 33 | 15 | 0 |
|  | 6 „ | Claret ............... | 66 | 0 = | 19 | 16 | 0 |
|  | 6 „ | Champagne ......... | 75 | 0 = | 22 | 10 | 0 |
|  | 3 „ | French Brandy ... | 66 | 0 = | 9 | 18 | 0 |
|  | 2 „ | Jamaica Rum ...... | 38 | 0 = | 3 | 16 | 0 |
|  | 4 „ | Scotch Whiskey ... | 37 | 6 = | 7 | 10 | 0 |
|  | 3 „ | Irish  „ ... | 38 | 6 = | 5 | 15 | 6 |
|  |  |  |  |  | £135 | 8 | 6 |

(8)...The trains are $(25+35 =)$ 60 miles nearer to each other
at the end of an hour than they were at starting;

hence, they will meet in $(200\div 60 =)$ 3 hrs. 20 min.

$$\begin{array}{cc} \text{hrs.} & \text{min.} \\ 10 & 30 \ \text{A.M.} \\ 3 & 20 \end{array}$$

$\therefore$ they will meet at $\overline{1\text{h. }50\text{m.}}$ P.M.

(9)...

$$\begin{array}{cc} & 10d. \\ 6d. & 16d. \\ \hline 6 \text{ gal.} & 4 \text{ gal.} \end{array}$$

there must be 6 gallons of beer to every 4 gallons of ale.

$$4 \ :\ 6 \ ::\ 36 \ :\ 54 \text{ gallons of beer}$$

(10)...     £342 10s. + £453 + £624 10s. = £1420

| £ | | £ | s. | | £ | s. | d. | | £ | s. | d. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1420 | : | 342 | 10 | :: | 517 | 14 | 2 | : | 124 | 17 | 4¾ | A. |

| £ | | £ | s. | | £ | s. | d. | | £ | s. | d. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1420 | : | 453 | 0 | :: | 517 | 14 | 2 | : | 165 | 3 | 1½ | B. |

| £ | | £ | s. | | £ | s. | d. | | £ | s. | d. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1420 | : | 624 | 10 | :: | 517 | 14 | 2 | : | 227 | 13 | 7¾ | C. |

## EXERCISE LXIX.

(1)...

| s. | d. | | | £ | s. | d. | |
|---|---|---|---|---|---|---|---|
| 2 | 6 | = ⅛ of £1 | | 2379 | 0 | 0 | = value at £1 each |
| 1 | 0 | = 1/20 of £1 | | 297 | 7 | 6 | |
| | 1½ | = ⅛ of 1s. | | 118 | 19 | 0 | |
| | | | | 14 | 17 | 4½ | |
| | | | | £431 | 3 | 10½ | |

| s. | d. | | | £ | s. | d. | |
|---|---|---|---|---|---|---|---|
| 10 | 0 | = ½ of £1 | | 3527 | 0 | 0 | = value at £1 each |
| 2 | 6 | = ¼ of 10s. | | 1763 | 10 | 0 | |
| 1 | 3 | = ½ of 2s. 6d. | | 440 | 17 | 6 | |
| | 2½ | = ⅙ of 1s. 3d. | | 220 | 8 | 9 | |
| | | | | 36 | 14 | 9½ | |
| | | | | £2461 | 11 | 0½ | |

(2)...     5 tons 13 cwt. 2 qrs. × 17 = 96 tons 9 cwt. 2 qrs.

|  | s. | d. | |
|---|---|---|---|
| | 12 | 6 | per ton |
| | | 8 × 12 = 96 | |
| | 5 | 0 | 0 |
| | | 12 | |
| | 60 | 0 | 0 |
| 5 cwt. = | | 3 | 1½ |
| 4 cwt. = | | 2 | 6 |
| 2 qrs. = | | | 3¾ |
| £60 | 5 | 11¼ | |

(3)...
$$
\begin{array}{cccccc}
\text{yds.} & & \text{yds.} & & \pounds \; s. \; d. & \\
29\tfrac{3}{4} & : & 34\tfrac{1}{4} & :: & 15\;12\;4\tfrac{1}{2} & : & x \\
4 & & 4 & & 20 & \\
\hline
119 & & 137 & & 312 & \\
& & & & 12 & \\
& & & & \overline{3748} & \\
& & & & 4 & \\
& & & & \overline{14994} &
\end{array}
$$

$$
x = \frac{137 \times \cancel{14994}}{\cancel{119}} = 17262 \text{ far.} = \pounds 17 \; 19s. \; 7\tfrac{1}{2}d.
$$

(4)...
$$
\begin{array}{r}
2500 \text{ pamphlets} \\
2\tfrac{1}{2} \\
\hline
5000 \\
1250 \\
24)\overline{6250} \text{ sheets} \\
20)\overline{260} \quad 10 \\
\hline
\text{reams } 13 \quad 10 \text{ sheets}
\end{array}
$$

(5)...
$$
\begin{array}{r}
\text{yds.} \\
237 \\
\tfrac{1}{4} \text{ mile} = 440 \text{ yds.} \\
\hline
9480 \\
948 \\
\hline
104280 \text{ sq. yds.} \\
4
\end{array}
$$

$$
\begin{array}{l}
\text{yds.} \quad\quad \text{qrs.} \\
30\tfrac{1}{4} = 121 \left\{
\begin{array}{l}
11)\overline{417120} \\
11)\overline{37920} \\
40)\overline{3447} \quad 3 \\
\hline
4)\overline{86} \quad 7 \text{ per.}
\end{array}
\right\} 33 \text{ qrs.} = 8\tfrac{1}{4} \text{ yds.}
\end{array}
$$

$$
\overline{21 \text{ ac. } 2 \text{ ro. } 7 \text{ per. } 8\tfrac{1}{4} \text{ yds.}}
$$

(6)...

A can do $\frac{1}{12}$ in 1 hour

B  „   „  $\frac{1}{10}$  „   „

C  „   „  $\frac{1}{9}$  „   „

$\therefore$ A+B+C can do $\frac{1}{12} + \frac{1}{10} + \frac{1}{9}$ in 1 hour

$$
\frac{1}{12} + \frac{1}{10} + \frac{1}{9} = \frac{15 + 18 + 20}{180} = \frac{53}{180}
$$

$$
\tfrac{53}{180} \; : \; 1 \; :: \; 1 \; : \; 3\tfrac{21}{53} \text{ hours}
$$

(7)... $$\frac{1}{6}+\frac{2}{9}+\frac{1}{4}+\frac{1}{6} = \frac{6+8+9+6}{36} = \frac{29}{36}$$

$$1-\tfrac{29}{36}=\tfrac{7}{36}$$

$$\overset{}{\tfrac{7}{36}} \ : \ 1 \ :: \ \overset{\text{boys}}{7} \ : \ \overset{\text{boys}}{36}$$

(8)... $$15+3+2 = 20$$

$$112 \text{ lb.} \div 20 = 5\tfrac{3}{5} \text{ lb.}$$

$$5\tfrac{3}{5} \text{ lb.} \times 15 = 84 \text{ lb. of nitre}$$

$$5\tfrac{3}{5} \text{ lb.} \times 3 = 16\tfrac{4}{5} \text{ lb. of charcoal}$$

$$5\tfrac{3}{5} \text{ lb.} \times 2 = 11\tfrac{1}{5} \text{ lb. of sulphur}$$

(9)...

$$\overset{\text{hrs. da.}}{16\times 6} \ : \ \overset{\text{hrs. da.}}{25\times x} \ :: \ \overset{\text{bu.}}{9} \ : \ \overset{\text{bu.}}{56\tfrac{1}{4}}$$

$$\underset{36}{4} \qquad \underset{225}{4}$$

$$x = \frac{\overset{4}{1\cancel{6}} \times 6 \times \overset{9}{\cancel{225}}}{\underset{}{\cancel{25} \times \cancel{36}}} = 24 \text{ days}$$

(10)...

$$\overset{\text{per. da.}}{8\times 5} \ : \ \overset{\text{per. da.}}{12\times x} \ :: \ \overset{\text{gal.}}{7\tfrac{1}{2}} \ : \ \overset{\text{gal.}}{36}$$

$$\underset{15}{2} \qquad \underset{72}{2}$$

$$x = \frac{8 \times \cancel{5} \times \overset{\overset{2}{\cancel{6}}}{\cancel{72}}}{\underset{\underset{3}{\cancel{3}}}{\cancel{12} \times \cancel{15}}} = 16 \text{ days}$$

## EXERCISE LXX.

(1)...
$$\tfrac{7}{10} = \cdot 7; \quad \tfrac{5}{16} = \cdot 3125; \quad \tfrac{13}{20} = \cdot 65;$$
$$\cdot 0275 = \tfrac{275}{10000} = \tfrac{11}{400}; \quad \cdot 624 = \tfrac{624}{1000} = \tfrac{78}{125}$$
$$\frac{7}{10} + \frac{11}{400} + \frac{5}{16} + \frac{78}{125} + \frac{13}{20} = \frac{1400 + 55 + 625 + 1248 + 1300}{2000}$$
$$= \tfrac{4628}{2000}$$
$$= 2\tfrac{628}{2000} = 2\tfrac{157}{500}$$

·7
·0275
·3125
·624
·65
————
2·314

(2)...
$$\frac{4}{7} \text{ of } \frac{5}{11} \text{ of } 6\tfrac{3}{10} = \frac{\cancel{4}^{\,2}}{7} \times \frac{\cancel{5}}{11} \times \frac{\cancel{63}^{\,9}}{\cancel{10}_{\,2}} = \frac{18}{11}$$

$$\frac{4}{9} \text{ of } 5\tfrac{2}{5} = \frac{4}{\cancel{9}} \times \frac{\cancel{27}^{\,3}}{5} = \frac{12}{5}$$

$$\frac{12}{5} - \frac{18}{11} = \frac{132 - 90}{55} = \frac{42}{55};$$

$$17\tfrac{3}{5} + (\tfrac{2}{3} \text{ of } 2\tfrac{1}{4}) = \frac{\cancel{88}^{\,8}}{\cancel{5}} \times \frac{\cancel{5}}{3} \times \frac{4}{\cancel{11}} = \frac{32}{3} = 10\tfrac{2}{3}$$

(3)...

cwt. qrs. lb.
7)4  2  0
  2 16
     5
3  0 24

cwt. qrs. lb.
16)7  3 12
   1 27
     11
5  1 17

cwt. qr. lb.
5  1 17
3  0 24
————
2  0 21

(4)...   3 acres, 1 rood, 20 perches = 16335 sq. yards

       sq. yds.      sq. yds.    hrs.

       $1075\frac{5}{9}$  :  16335  ::  $3\frac{1}{3}$  :  $x$

$$x = \frac{\overset{3}{\overset{9}{\cancel{9680}}}}{\underset{8}{\cancel{968}}} \times \frac{\overset{135}{\cancel{16335}}}{1} \times \frac{\cancel{10}}{\cancel{3}} = \frac{405}{8} \text{ hrs.} = 50\frac{5}{8} \text{ hours}$$

(5)...
```
   2·36                      14·125)101·9825(7·22
    ·58                             98875
  ------                           ------
   1888                             31075
   1180                             28250
  ------                           ------
  1·3688                             28250
                                    28250
                                   ------
```

(6)...
```
                        £
                      15750
                         5½
                      ------
                      78750
                       7875
                      ------
                      86625   value of cargo
                      15750   value of ship
                 ⎧3)102375
              24 ⎨
                 ⎩8) 34125
                   ------------
                      4265 12  6
                              7
                   ------------
                   £29859  7  6
```

(7)...
```
                    ⅞ mile = 1540 yds.
                    ¾ mile = 1320 yds.
                           ------
                           30800
                            4620
        sq. yds.           1540
1 acre = 4840)2032800(420 acres
                   19360
                   ------
                    9680
                    9680
                   ------
                   ....0
```

(8)... 1.

| s. d. | £ s. d. |
|---|---|
| 2 0 = $\frac{1}{10}$ of £1 | 739 0 0 = value at £1 per bu. |
| 4 = $\frac{1}{6}$ of 2s. | 73 18 0 |
| 1 = $\frac{1}{4}$ of 4d. | 12 6 4 |
| $\frac{1}{2}$ = $\frac{1}{2}$ of 1d. | 3 1 7 |
| | 1 10 9$\frac{1}{2}$ |
| | £90 16 8$\frac{1}{2}$ |

2.

| | £ s. d. |
|---|---|
| 10 cwt. = $\frac{1}{2}$ of 1 ton | 14 2 per ton |
| | 7 |
| | 4 19 2 |
| 2$\frac{1}{2}$ cwt. = $\frac{1}{4}$ of 10 cwt. | 7 1 |
| 1 cwt. = $\frac{1}{10}$ of 10 cwt. | 1 9$\frac{1}{2}$ |
| | 8$\frac{1}{2}$ |
| | £5 8 8$\frac{3}{4}$ |

3.

| | £ s. d. |
|---|---|
| 10 dwt. = $\frac{1}{2}$ of 1 oz. | 3 17 6 per ounce |
| | 17 |
| | 65 17 6 |
| 5 dwt. = $\frac{1}{2}$ of 10 dwt. | 1 18 9 |
| 12 grs. = $\frac{1}{10}$ of 5 dwt. | 19 4$\frac{1}{2}$ |
| | 1 11$\frac{1}{4}$ |
| | £68 17 6$\frac{3}{4}$ |

(9)...

$$1 - \tfrac{7}{9} = \tfrac{2}{9}$$

$$\tfrac{2}{9} \text{ of army} = \begin{cases} 750 \times 5 = 3750 \\ 850 \times 2 = 1700 \end{cases}$$

$$\overline{5450} \text{ men}$$

$$\tfrac{2}{9} \; : \; 1 \; :: \; 5450 \; : \; x$$

$$\frac{9}{2} \times \frac{\overset{2725}{\cancel{5450}}}{1} = 24525 \text{ men}$$

(10)...
| la. da. | | la. da. | | £ | s. | d. | | |
|---------|---|---------|----|----|----|----|---|---|
| 7 × 6   | : | 5 × 9   | :: | 8  | 13 | 6  | : | $x$ |

$$
\begin{array}{r}
20 \\
\hline
73 \\
12 \\
\hline
882
\end{array}
$$

$$
\begin{array}{r}
21 \\
126 \\
\end{array}
$$

$$
x = \frac{5 \times 9 \times 882}{7 \times 6} = 945d. = £3 \; 18s. \; 9d.
$$

## *EXERCISE LXXI.*

(1)...
                              bu.

From Portugal ...... 218480
   ,,    Spain ......... 158674
   ,,    The Azores ... 627709
   ,,    Sicily ......... 140983
   ,,    other places...   8564

$$
\begin{array}{r}
\overline{1154410} \text{ bushels} \\
650 \\
\hline
57720500 \\
6926460 \\
\end{array}
$$

$$
12)\overline{750366500} \text{ oranges}
$$

$$
\begin{array}{r}
\overline{62530541\tfrac{2}{3}} \text{ dozen} \\
4\tfrac{1}{2}d. \\
\hline
2501221 66\tfrac{2}{3} \\
31265270\tfrac{5}{6} \\
\end{array}
$$

$$
12)\overline{281387437\tfrac{1}{2}}
$$

$$
20)\;\; \overline{23448953} \quad 1\tfrac{1}{2}
$$

$$
\overline{£1172447} \; 13s. \quad 1\tfrac{1}{2}d.
$$

(2)...
$$
5\tfrac{1}{2} + 6\tfrac{1}{2} = 12
$$

| | | | | £ | s. | | £ | s. | d. |
|---|---|---|----|------|----|---|------|----|---|
| 12 | : | 5½ | :: | 5707 | 10 | : | 2615 | 18 | 9 |

| | | | | £ | s. | | £ | s. | d. |
|---|---|---|----|------|----|---|------|----|---|
| 12 | : | 6½ | :: | 5707 | 10 | : | 3091 | 11 | 3 |

$$
\begin{array}{cc}
 & \textit{s.} \quad \textit{d.} \\
(3)\ldots & 46 \quad 3 \\
 & \underline{43 \quad 6} \\
\text{profit in Essex wheat} & 2 \quad 9 \text{ per quarter}
\end{array}
$$

$$
\begin{array}{cc}
 & \textit{s.} \quad \textit{d.} \\
 & 58 \quad 6 \\
 & \underline{55 \quad 0} \\
\text{profit on Dantzic wheat} & 3 \quad 6 \text{ per quarter}
\end{array}
$$

$$
\begin{array}{ll}
 & \quad\quad £ \quad \textit{s.} \quad \textit{d.} \\
2s.\ 9d. \times 65 = & 8 \quad 18 \quad 9 \\
3s.\ 6d. \times 85 = & \underline{14 \quad 17 \quad 6} \\
\text{gain by whole} = & £23 \quad 16 \quad 3
\end{array}
$$

$$
\begin{array}{cccccc}
 & £ \quad \textit{s.} & & £ & & £ \quad \textit{s.} \quad \textit{d.} \\
(4)\ldots & 36757 \ 10 & : & 1 & :: & 12175 \ 18 \ 5\tfrac{1}{4} \quad : \quad x \\
 & \underline{2} & & \underline{2} & & \underline{20} \\
 & 73515 & & 2 & & 243518 \\
 & & & & & \underline{12} \\
 & & & & & 2922221 \\
 & & & & & \underline{4} \\
 & & & & & 11688885
\end{array}
$$

$$
x = \frac{2 \times \overset{159}{\cancel{11688885}}}{\cancel{73515}} = 318 \text{ far.} = 6s.\ 7\tfrac{1}{2}d. \text{ in the } £
$$

$$
\begin{aligned}
(5)\ldots \quad 3\tfrac{4}{5} + 4\tfrac{2}{9} + 5\tfrac{5}{8} + 6\tfrac{3}{10} &= 18 + \tfrac{4}{5} + \tfrac{2}{9} + \tfrac{5}{8} + \tfrac{3}{10} \\
&= 18 + \frac{288 + 80 + 225 + 108}{360} \\
&= 18 + 1\tfrac{341}{360} \\
&= 19\tfrac{341}{360}
\end{aligned}
$$

$$
25 - 19\tfrac{341}{360} = 5\tfrac{19}{360}
$$

(6)...
$$\tfrac{3}{4})5\tfrac{1}{4} \quad 7\tfrac{1}{2} \quad 9$$
$$2)7 \quad 10 \quad 12$$
$$\overline{\phantom{2)}7 \quad \phantom{1}5 \quad \phantom{1}6}$$

$$\text{L.C.M.} = \tfrac{3}{4} \times 2 \times 7 \times 5 \times 6 = 315$$

(7)...

| t. | qrs. lb. |
|---|---|
| ·034375 = | 2 21 |

    20

·687500

     4

2·750000 qrs.

    28

21·000000 lb.

| cwt. | qrs. lb. |
|---|---|
| ·90625 = | 3 17½ |

    4

3·62500 qrs.

    28

17·50000 lb.

3 qrs. 17½ lb. − 2 qrs. 21 lb. = 24½ lb.

(8)...
9 mi. 3 fur. 165½ yds. = 599958 in.

```
39·371)599958(15238·5766 mètres
       39371
       ──────
       206248
       196855
        ─────
        93930
        78742
        ─────
       151880
       118113
        ─────
       337670
       314968
        ─────
       227020
       196855
        ─────
       301650
       275597
        ─────
       260530
       236226
        ─────
       243040
       236226
        ─────
        12814
```

L

(9)...       36 yds. at 3$d$. = $\begin{array}{cc} s. & d. \\ 9 & 0 \end{array}$

cost $\begin{array}{cc} 8 & 0 \end{array}$

profit $\overline{\begin{array}{cc} 1 & 0 \end{array}}$ per piece

$\underset{8}{\overset{s.}{}}$ : $\underset{1}{\overset{s.}{}}$ :: 100 : 12½ per cent

(10)...  $\underset{5 \times 32 \times 15}{\overset{\text{fl. w. ho.}}{}}$ : $\underset{5 \times 40 \times 17\frac{1}{2}}{\overset{\text{fl. w. ho.}}{}}$ :: $\underset{10}{\overset{\text{t.}}{}}$ : $x$

$\begin{array}{cc} 2 & 2 \\ \overline{30} & \overline{35} \end{array}$

$$x = \frac{\overset{5}{\cancel{5}} \times \cancel{40} \times 35 \times \cancel{10}}{\cancel{5} \times \underset{4}{\cancel{32}} \times \underset{3}{\cancel{30}}} = \frac{175}{12}\text{t.} = 14\tfrac{7}{12} \text{ tons}$$

### EXERCISE LXXII.

(1)...          1 acre = 4840 sq. yards

                        5
                    ‾‾‾‾‾
                    24200
                        2

137½ yds. ×2 = 275)$\overline{48400}$(176 gardens
                    275
                   ‾‾‾‾
                   2090
                   1925
                   ‾‾‾‾
                   1650
                   1650
                   ‾‾‾‾

(2)...        $\begin{array}{cccc} \text{wks.} & \text{da.} & \text{hrs.} & \text{min.} \\ 35 & 3 & 15 & 25 \\ 17 & 6 & 22 & 39 \\ \hline 17 & 3 & 16 & 46 \end{array}$

                    7
                  ‾‾‾‾
                  122
                   24
                  ‾‾‾‾
                  504
                  244
                 ‾‾‾‾
                 2944
                   60
                ‾‾‾‾‾
                176686
                   60
              ‾‾‾‾‾‾‾
              10601160 seconds

(3)...        5 cwt. 3 qrs. = 644 lb.
                        5d.
                 12)3220
                   20)268   4
                   ───────────
                      13   8   4
        11½ guineas = 12   1   6
                   ──────────────
                  profit £1   6  10

(4)...

$$\frac{11}{18}\text{ gui.} = \frac{11}{\cancel{18}_{6}} \times \frac{\overset{7}{\cancel{21}}}{1} = \frac{77}{6} = \overset{£\ \ s.\ \ d.}{0\ \ 12\ \ 10}$$

$$\frac{13}{15}\text{ sov.} = \frac{13}{\underset{3}{\cancel{15}}} \times \frac{\overset{4}{\cancel{20}}}{1} = \frac{52}{3} = 0\ \ 17\ \ \ \ 4$$

$$\frac{9}{16}\text{ cro.} = \frac{9}{16} \times \frac{5}{1} = \frac{45}{16} = 0\ \ 2\ \ 9\tfrac{3}{4}$$

$$\frac{7}{8}\text{ flo.} = \frac{7}{\underset{4}{\cancel{8}}} \times \frac{\cancel{2}}{1} = \frac{7}{4} = 0\ \ 1\ \ 9$$
$$£1\ \ 14\ \ 8\tfrac{3}{4}$$

(5)...

$$\frac{4}{9}\text{ of }\frac{3}{8}\text{ of }\frac{5}{6}\text{ of }4\tfrac{1}{2}\text{ gui.} = \frac{\cancel{4}}{9} \times \frac{\cancel{3}}{\underset{2}{\cancel{8}}} \times \frac{5}{\underset{2}{\cancel{6}}} \times \frac{\overset{21}{\cancel{189}}}{2} = \frac{105}{8} = \overset{s.}{13}\ \ \overset{d.}{1\tfrac{1}{2}}$$

$$\frac{3}{7}\text{ of }\frac{5}{6}\text{ of }\frac{3}{10}\text{ of }5\text{ gui.} = \frac{\cancel{3}}{7} \times \frac{\cancel{5}}{\underset{2}{\cancel{6}}} \times \frac{3}{\underset{2}{\cancel{10}}} \times \frac{\overset{15}{\cancel{105}}}{1} = \frac{45}{4} = \overset{11\ \ 3}{1\ \ 10\tfrac{1}{2}}$$

(6)...   1.    $(72·65 + 109·125 - 27·19) \times 9·14$
            $= 154·585 \times 9·14$
            $= 1412·9069$

2.    $\{(37 \cdot 42 + 21 \cdot 33) \times (50 \cdot 06 - 27 \cdot 56)\} \div 2 \cdot 35$

$= (58 \cdot 75 \times 22 \cdot 5) \div 2 \cdot 35$

$= 1321 \cdot 875 \div 2 \cdot 35$

$= 562 \cdot 5$

(7)...

| gui. | sov. |
|------|------|
| $\cdot 5625 = 11s.\ 9\frac{3}{4}d.$ | $\cdot 109375 = 2s.\ 2\frac{1}{4}d.$ |
| 21 | 20 |
| $\overline{11 \cdot 8125}s.$ | $\overline{2 \cdot 187500}s.$ |
| 12 | 12 |
| $\overline{9 \cdot 7500}d.$ | $\overline{2 \cdot 250000}d.$ |
| 4 | 4 |
| $\overline{3 \cdot 0000}$ far. | $\overline{1 \cdot 000000}$ far. |

| hf. cr. | s. |
|---------|----|
| $\cdot 45 = 1s.\ 1\frac{1}{2}d.$ | $\cdot 8125 = 9\frac{3}{4}d.$ |
| $2 \cdot 5s.$ | 12 |
| $\overline{1 \cdot 125}s.$ | $\overline{9 \cdot 7500}d.$ |
| 12 | 4 |
| $\overline{1 \cdot 500}d.$ | $\overline{3 \cdot 0000}$ far. |
| 4 | |
| $\overline{2 \cdot 000}$ far. | |

| s. | d. |
|----|----|
| 11 | $9\frac{3}{4}$ |
| 2 | $2\frac{1}{4}$ |
| 1 | $1\frac{1}{2}$ |
| 0 | $9\frac{3}{4}$ |
| $\overline{15s.}$ | $\overline{11\frac{1}{4}d.}$ |

(8)...                    $s.$

$12s.\ 6d. \times 2 = 25$

5

wages of 2 men and 1 boy $= \overline{30}s.$ per week

$10$ gui. $+ 30s. = 210s. + 30s. = 7$

$\therefore$ he employs (2 men and 1 boy) $\times 7$

i.e. 14 men and 7 boys

(9)...

$$\begin{array}{rrr} \pounds & s. & d. \\ 533 & 12 & 6 \end{array}$$

5 per cent. $= \frac{1}{20} = \overline{\begin{array}{rrr} 26 & 13 & 7\frac{1}{5} \\ & & 3\frac{1}{2} \end{array}}$ interest for 1 year

$$\overline{\begin{array}{rrr} 80 & 0 & 10\frac{1}{2} \\ 13 & 6 & 9\frac{3}{4} \end{array}}$$

$\overline{\pounds 93 \quad 7 \quad 8\frac{1}{4}}$ interest for $3\frac{1}{2}$ years

(10)...
$$\begin{array}{c} \pounds \\ 82\frac{1}{2} \\ 20 \\ \hline 1650 \end{array} \quad : \quad \begin{array}{cc} \pounds & s. \\ 1113 & 15 \\ 20 & \\ \hline 22275 & \end{array} \quad :: \quad \begin{array}{cc} \pounds & s. \\ 3 & 10 \\ 20 & \\ \hline 70 & \end{array} \quad : \quad \text{income req.}$$

annual income $= \dfrac{\overset{27}{\cancel{22275}} \times \overset{35}{\cancel{70}}}{\underset{\cancel{2}}{\cancel{1650}}} = 945s. = \pounds 47 \ 5s.$

## EXERCISE LXXIII.

(1)...
$$\begin{array}{r} \pounds \quad s. \quad d. \\ 10297 \ 18 \ 10 \\ 20 \\ \hline 205958 \\ 12 \\ \hline 4)2471506 \\ \hline 617876 \text{ persons; and } 2d. \text{ over} \end{array}$$

(2)...

1. $\dfrac{5}{13} - \dfrac{2}{9} + \dfrac{4}{11} + \dfrac{5}{6} - \dfrac{4}{7} = \dfrac{6930 - 4004 + 6552 + 15015 - 10296}{18018}$

$$= \dfrac{14197}{18018}$$

2. $\dfrac{4\frac{1}{7}-2\frac{5}{6}}{8\frac{3}{7}+3\frac{5}{8}} = \dfrac{4\frac{6}{42}-2\frac{35}{42}}{8\frac{24}{56}+3\frac{35}{56}} = \dfrac{1\frac{13}{42}}{12\frac{3}{56}} = \dfrac{\frac{55}{42}}{\frac{675}{56}}$

$$= \dfrac{\overset{11}{\cancel{55}}\times\overset{4}{\cancel{56}}}{\underset{135}{\cancel{675}}\times\underset{3}{\cancel{42}}} = \dfrac{44}{405}$$

$\dfrac{5\frac{4}{9}+6\frac{2}{5}}{7\frac{1}{5}-1\frac{5}{9}} = \dfrac{5\frac{20}{45}+6\frac{18}{45}}{7\frac{9}{45}-1\frac{25}{45}} = \dfrac{11\frac{38}{45}}{5\frac{29}{45}} = \dfrac{\frac{533}{45}}{\frac{264}{45}} = \dfrac{533}{254}$

$$\dfrac{\overset{22}{\cancel{44}}}{405}\times\dfrac{533}{\underset{127}{\cancel{254}}} = \dfrac{11726}{51435}$$

3. $\dfrac{8\frac{1}{3}}{10\frac{5}{6}} = \dfrac{\frac{25}{3}}{\frac{65}{6}} = \dfrac{\overset{5}{\cancel{25}}\times\overset{2}{\cancel{6}}}{\underset{13}{\cancel{65}}\times\cancel{3}} = \dfrac{10}{13}$

$\dfrac{5\frac{4}{7}}{7} = \dfrac{\frac{39}{7}}{\frac{7}{1}} = \dfrac{39}{49}$  $\qquad$  $\dfrac{8}{9\frac{3}{5}} = \dfrac{\frac{8}{1}}{\frac{48}{5}} = \dfrac{40}{48} = \dfrac{5}{6}$

$\dfrac{6\frac{3}{10}}{4\frac{3}{5}} = \dfrac{\frac{63}{10}}{\frac{8}{2}} = \dfrac{\overset{7}{\cancel{63}}\times\cancel{2}}{9\times\underset{5}{\cancel{10}}} = \dfrac{7}{5}$

$\dfrac{\overset{5}{\cancel{10}}}{\cancel{13}}\times\dfrac{\overset{3}{\cancel{39}}}{\underset{7}{\cancel{49}}}\times\dfrac{\cancel{5}}{\underset{2}{\cancel{6}}}\times\dfrac{7}{\cancel{5}} = \dfrac{5}{7}$

(3)...
$$\frac{7}{270} \text{ yd.} = \frac{7}{\cancel{270}} \times \frac{\overset{2}{\cancel{36}}}{1} = \frac{14}{15} \text{ of an inch;}$$

$$\frac{9}{10} \text{ in.} = \frac{9}{10} \times \frac{1}{\underset{4}{\cancel{36}}} = \frac{1}{40} \text{ of a yard}$$

(4)...

| 79·2416 | ·056)·019320(·345 |
|---|---|
| ·076 | 168 |
| 4754496 | 252 |
| 5546912 | 224 |
| 6·0223616 | 280 |
| | 280 |

(5)...
gui.
·9375 = 19s. 8¼d.
21

| 19·6875s. | 4) 1 |
|---|---|
| 12 | 12)11·25 |
| 8·2500d. | 40)13·9375 |
| 4 | 13s. 11¼d. = ·3484375 of a sov. |
| 1·0000 far. | |

(6)...

| | | | | s. | d. | £ | s. | d. |
|---|---|---|---|---|---|---|---|---|
| 2⅝ yds. | Black cloth...... | 16 | 6 = | 2 | 3 | 3¾ |
| 2⅜ „ | Doeskin ......... | 7 | 6 = | 0 | 17 | 9¾ |
| 3¼ „ | Alpaca............ | 1 | 6 = | 0 | 4 | 10¼ |
| 1¾ „ | Shalloon ......... | 1 | 8 = | 0 | 2 | 11 |
| 5½ „ | Scarlet flannel . | 1 | 10 = | 0 | 10 | 1 |
| | | | | | £3 | 19 | 0 |

(7)...

| | s. | d. | | £ | s. | d. |
|---|---|---|---|---|---|---|
| 19¾ yds. at | 11 | 6 per yard = | | 11 | 7 | 1¼ |
| 23¾ „ | 12 | 6 „ = | | 14 | 16 | 10½ |
| 43½ | | | selling price | 26 | 4 | 0 |
| | | | cost price | 22 | 5 | 10½ |
| | | | profit | £3 | 18 | 1½ |

(8)...        Longitude of Vienna .........16° 23′ E.
                „        Washington ...77°  1′ W.
              difference of longitude = $\overline{93°\ 24′}$

$$\begin{array}{ccccccc} & & & & \text{min.} & & \\ 1° & : & 93° & 24′ & :: & 4 & : & x \\ 60 & & & 60 & & & \\ \overline{60} & & \overline{5604} & & & & \end{array}$$

$$x = \frac{\cancel{5604} \times \cancel{4}}{\cancel{60}} = \frac{1868}{5} \text{ min.} = 6 \text{ hrs. } 13 \text{ min. } 36 \text{ sec.}$$

∴ the clocks of Vienna are 6 hrs. 13 min. 36 sec. in advance
of those of Washington.

(9)...
$$\begin{array}{l} \phantom{x}\text{per cent.} \\ 2\frac{1}{2} = \tfrac{1}{40} \text{ of } 100 \\ 1\frac{1}{4} = \tfrac{1}{2} \text{ of } 2\frac{1}{2} \end{array}$$

$$\begin{array}{rcl} & \pounds\ \ s.\ \ d. \\ & 593\ 10\ \ 0 \\ \hline & 14\ 16\ \ 9 \\ & 7\ \ 8\ \ 4\frac{1}{2} \\ \hline & 22\ \ 5\ \ 1\frac{1}{2}\ \text{ int. for 1 year} \\ & 5\frac{1}{2} \\ \hline & 111\ \ 5\ \ 7\frac{1}{2} \\ & 11\ \ 2\ \ 6\frac{3}{4} \\ \hline \pounds & 122\ \ 8\ \ 2\frac{1}{4}\ \text{ int. for } 5\frac{1}{2} \text{ years} \end{array}$$

$$\begin{array}{lrcl} & \pounds & s. & d. \\ \text{Principal...} & 593 & 10 & 0 \\ \text{Interest ...} & 122 & 8 & 2\frac{1}{4} \\ \text{Amount ...} & \overline{715} & 18 & 2\frac{1}{4} \end{array}$$

(10)...
$$\begin{array}{ccccccc} \pounds & & \pounds & & \pounds & & \\ 73\frac{7}{8} & : & 1250 & :: & 100 & : & \text{stock required} \\ 8 & & 8 & & & & \\ \overline{591} & & \overline{10000} & & & & \end{array}$$

∴ stock required $= \dfrac{10000 \times 100}{591} = \pounds\dfrac{1000000}{591}$

$$= \pounds 1692\ 0s.\ 11\tfrac{73}{197}d.$$

## EXERCISE LXXIV.

(1)...  1.
$$
\begin{array}{ll}
\textit{s.} \ \ \textit{d.} & \qquad \textit{£} \quad \textit{s.} \quad \textit{d.} \\
2 \ \ 6 \ = \tfrac{1}{8} \text{ of } \text{£}1 & 349 \quad 0 \quad 0 = \text{value at £1 per cwt.} \\
1 \ \ 0 \ = \tfrac{1}{20} \text{ of } \text{£}1 & \ 43 \quad 12 \quad 6 \\
1\tfrac{1}{2} = \tfrac{1}{8} \text{ of } 1s. & \ 17 \quad 9 \quad 0 \\
& \quad \ 2 \quad \ 3 \quad 7\tfrac{1}{2} \\
\hline
& \text{£}412 \quad 5 \quad 1\tfrac{1}{2}
\end{array}
$$

2.
$$
\begin{array}{l}
\qquad \quad \textit{s.} \quad \textit{d.} \\
\qquad \ 13 \quad 9 \ \text{ per E. ell} \\
\qquad \qquad 6 \times 12 + 1 = 73 \\
\hline
\qquad \ \ 4 \quad 2 \quad 6 \\
\qquad \qquad \quad 12 \\
\hline
\end{array}
$$

$$
\begin{array}{ll}
\textit{qrs. na.} & \ 49 \quad 10 \quad 0 \\
2 \ \ 2 = \tfrac{1}{2} \text{ of } 1 \text{ ell} & \ 13 \quad 9 \\
1 \ \ 0 = \tfrac{1}{8} \text{ of } 1 \text{ ell} & \quad 6 \quad 10\tfrac{1}{2} \\
& \quad 2 \quad 9 \\
\hline
& \text{£}50 \quad 13 \quad 4\tfrac{1}{2}
\end{array}
$$

3.
$$
\begin{array}{l}
\qquad \ \textit{£} \quad \textit{s.} \quad \textit{d.} \\
\qquad \ 12 \quad 12 \quad 0 \ \text{ per acre} \\
\qquad \qquad \quad 3 \times 11 + 1 = 34 \\
\hline
\qquad \ 37 \quad 16 \quad 0 \\
\qquad \qquad \quad 11 \\
\hline
\end{array}
$$

$$
\begin{array}{ll}
\textit{ro. po.} & 415 \quad 16 \quad 0 \\
2 \ \ \ 0 = \tfrac{1}{2} \text{ of } 1 \text{ ac.} & \ 12 \quad 12 \quad 0 \\
1 \ \ \ 0 = \tfrac{1}{2} \text{ of } 2 \text{ ro.} & \quad 6 \quad \ 6 \quad 0 \\
\quad 20 = \tfrac{1}{2} \text{ of } 1 \text{ ro.} & \quad 3 \quad \ 3 \quad 0 \\
\quad \ 5 = \tfrac{1}{4} \text{ of } 20 \text{ po.} & \quad 1 \quad 11 \quad 6 \\
& \quad 7 \quad 10\tfrac{1}{2} \\
\hline
& \text{£}439 \quad 16 \quad 4\tfrac{1}{2}
\end{array}
$$

(2)...Right length $= 42$ yds. $-(\tfrac{3}{4}$ in. $\times 42) = 42$ yds. $-31\tfrac{1}{2}$ in.
$$
\begin{aligned}
&= 41 \text{ yds. } 4\tfrac{1}{2} \text{ in.} \\
&= 41\tfrac{1}{8} \text{ yds.}
\end{aligned}
$$

(3)...
$$
3\tfrac{4}{5} + 2\tfrac{3}{8} = 3\tfrac{32}{40} + 2\tfrac{15}{40} = 6\tfrac{7}{40} \text{ sum}
$$
$$
3\tfrac{4}{5} - 2\tfrac{3}{8} = 3\tfrac{32}{40} - 2\tfrac{15}{40} = 1\tfrac{17}{40} \text{ difference}
$$
$$
3\tfrac{4}{5} \times 2\tfrac{3}{8} = \tfrac{19}{5} \times \tfrac{19}{8} = \tfrac{361}{40} = 9\tfrac{1}{40} \text{ product}
$$
$$
3\tfrac{4}{5} \div 2\tfrac{3}{8} = \frac{\cancel{19}}{5} \times \frac{8}{\cancel{19}} = \frac{8}{5} = 1\tfrac{3}{5} \text{ quotient}
$$

(4)...        $25 \begin{cases} 5)7 \\ 5)\overline{1\cdot4} \end{cases}$        $32 \begin{cases} 4)13 \\ 8)\ \overline{3\cdot35} \end{cases}$
                    $\cdot28$                                $\cdot40625$

(5)...        $\dfrac{7}{24}$ gui. $= \dfrac{7}{\overset{3}{\underset{8}{24}}} \times \dfrac{\overset{7}{\overset{s.}{21}}}{1} = \dfrac{49}{8} = 6s.\ 1\tfrac{1}{2}d.$

$$\begin{array}{l} \overset{\text{sov.}}{\cdot528125} = 10s\ 6\tfrac{3}{4}d. \\ \underline{\quad20\quad} \\ 10\cdot562500s. \\ \underline{\quad12\quad} \\ 6\cdot750000d. \\ \underline{\quad4\quad} \\ 3\cdot000000\ \text{far.} \end{array}$$

$10s.\ 6\tfrac{3}{4}d. - 6s.\ 1\tfrac{1}{2}d. = 4s.\ 5\tfrac{1}{4}d.$

(6)...        5 fur. $137\tfrac{1}{2}$ yds. $= 2475$ hf.-yds.
                    1 mile $= 3520$        ,,

$\tfrac{2475}{3520} \div \tfrac{55}{55} = \tfrac{45}{64}$ of a mile

$$\begin{array}{l} 4)\ 2 \\ 40)\overline{22\cdot5} \\ 4)\ \overline{2\cdot5625} \end{array}$$
2 ro. $22\tfrac{1}{2}$ per. $=\quad\cdot640625$ of an acre

(7)...                $11 + 3 = 14$

$$\begin{array}{ccccc} & & & \pounds & s. \\ 14 & : & 11 & :: & 58\ 16 & : & \text{cost of horse} \\ & & & \underline{20} \\ & & & 1176 \end{array}$$

cost of horse $= \dfrac{11 \times \overset{84}{\cancel{1176}}}{\cancel{14}} = 924s. = \pounds46\ 4s.$

$\therefore$ the cost of the harness $= \pounds58\ 16s. - \pounds46\ 4s.$
                            $= \pounds12\ 12s.$

(8)...                          If A has  4 shares
                              B will have  6   ,,
                            and C      ,,   15   ,,
    ∴  the property must be divided into $\overline{25}$ shares

$$\begin{array}{c} \text{£}\quad s.\quad d. \\ 25\left\{\begin{array}{l} 5)\overline{578\ \ 2\ \ 6} \\ 5)\overline{115\ 12\ \ 6} \end{array}\right. \\ \overline{\text{£}23\ \ \ 2\ \ \ 6}\ \text{ value of each share} \end{array}$$

£23   2s.   6d. × 4 =   £92 10s.   0d.......A's portion
£23   2s.   6d. × 6 = £138 15s.   0d.......B's    ,,
£23   2s.   6d. ×15 = £346 17s.   6d.......C's    ,,


   ,men da.  men da.   lb.    lb.
(9) ..   23 × 17   :   35 × $x$   ::   488¾   :   1881¼
              4    4
             $\overline{1955}$  $\overline{7525}$

$$x = \frac{23 \times 17 \times 7525}{35 \times 1955} = 43 \text{ days}$$


    per. da.  per. da.  £  s.
(10)...  3 × 11   :   7 × 35   ::   24 15   .   $x$
               20
             $\overline{495}$

$$x = \frac{7 \times 35 \times 495}{3 \times 11} = 3675s. = \text{£}183\ 15s.$$

## EXERCISE LXXV.

| | | | | s. | d. | | £ | s. | d. |
|---|---|---|---|---|---|---|---|---|---|

(1)...  11¼ yds. Glacé Silk.........5  6  = 3   3   3
  1¼ „  Silk Velvet ......8  6  = 0  10  7½
  6¾ „  French Merino ...4  9  = 1  12  0¾
  7½ „  Lining ............0  6½ = 0   4  0¾
  10½ „  Calico ............0  8½ = 0   7  5¼
  6¾ „  Flannel ............1 10  = 0  12  4½
  4⅓ „  Ribbon ............0 10½ = 0   3  11¼
  8 Cambric Handkerchiefs 2  9  = 1   2  0
  3 pairs Kid Gloves ......2  6  = 0   7  6
                              £8   3   3

(2)...  $\cdot 4375 = \frac{4375}{10000} = \frac{7}{16}$

$$16\begin{cases} 4)747\ 15\ \ 0 \\ 4)\overline{186\ 18\ \ 9} \end{cases}$$

            46 14   8¼
                    7
            £327  2  9¾

(3)...   22s. 6d. × 75 = 1687s. 6d. value of oats

        d.           12
43s. 9d. = 525)20250(38 quarters of wheat
            1575
            ―――
            4500
            4200
            ―――
             300
             ――― = ⅔
             525

(4)...   47 sheep cost  £ s.
                        67 10
        35 „    „    55  0
        ――      ――   ――――――
        82 „    „    122 10

                              £   s.
        82 sheep at 30s. each = 123   0
                        cost   122  10
                        profit        10s.

$$
\begin{array}{l}
\quad\; s. \quad d. \\
(5)...10 \quad 0 \;=\; \tfrac{1}{2}\text{ of }\pounds 1 \\
\quad\;\; 4 \quad 0 \;=\; \tfrac{1}{5}\text{ of }\pounds 1 \\
\qquad\quad 10 \;=\; \tfrac{1}{12}\text{ of }10s. \\
\qquad\quad \tfrac{1}{8} = \tfrac{1}{10}\text{ of }10d. \\
\qquad\quad \tfrac{1}{4} = \tfrac{1}{2}\text{ of }\tfrac{1}{2}d.
\end{array}
\left|
\begin{array}{rrl}
\pounds \quad & s. & d. \\
1747 & 0 & 0 \text{ value at }\pounds 1\text{ each} \\ \hline
873 & 10 & 0 \\
349 & 8 & 0 \\
72 & 15 & 10 \\
3 & 12 & 9\tfrac{1}{2} \\
1 & 16 & 4\tfrac{3}{4} \\ \hline
\pounds 1301 & 3 & 0\tfrac{1}{4}
\end{array}\right.
$$

$$
\begin{array}{l}
\quad s. \quad d. \\
10 \quad 0 \;=\; \tfrac{1}{2}\text{ of }\pounds 1 \\
\;6 \quad 8 \;=\; \tfrac{1}{3}\text{ of }\pounds 1 \\
\;1 \quad 8 \;=\; \tfrac{1}{4}\text{ of }6s.\,8d. \\
\qquad 1 \;=\; \tfrac{1}{20}\text{ of }1s.\,8d. \\
\qquad \tfrac{1}{2} = \tfrac{1}{2}\text{ of }1d.
\end{array}
\left|
\begin{array}{rrl}
\pounds \quad & s. & d. \\
2139 & 0 & 0 \text{ value at }\pounds 1\text{ each} \\ \hline
1069 & \!\!\cdot 10 & 0 \\
713 & 0 & 0 \\
178 & 5 & 0 \\
8 & 18 & 3 \\
4 & 9 & 1\tfrac{1}{2} \\ \hline
\pounds 1974 & 2 & 4\tfrac{1}{2}
\end{array}\right.
$$

(6)...

1. $\dfrac{7\frac{5}{8}+\frac{4}{9}-2\frac{5}{12}}{4\frac{4}{9}-3\frac{1}{8}+8\frac{5}{8}} = \dfrac{7\frac{30}{36}+\frac{16}{36}-2\frac{15}{36}}{4\frac{16}{24}-3\frac{4}{24}+8\frac{15}{24}} = \dfrac{5\frac{31}{36}}{10\frac{3}{24}}$

$$= \dfrac{\frac{211}{36}}{\frac{243}{24}} = \dfrac{211\times 24}{243\times 36} = \dfrac{422}{729}$$

2. $\dfrac{\frac{7}{9}\text{ of }\frac{11}{14}\text{ of }5\frac{8}{11}}{\frac{1}{10}\text{ of }\frac{13}{18}\text{ of }5\frac{5}{13}} = \dfrac{\frac{7}{9}\times\frac{11}{14}\times\frac{63}{11}}{\frac{9}{10}\times\frac{13}{18}\times\frac{70}{13}} = \dfrac{\frac{7}{4}}{\frac{7}{3}} = 1$

(7)...

$$
18\left\{
\begin{array}{l}
\quad\; \pounds \quad s. \quad d. \\
3)\overline{5\;\;15\;\;\;6} \\
6)\overline{1\;\;18\;\;\;6} \\
\qquad \overline{\;\;6\quad 5\;} \\
\qquad\quad\;\; 7 \\
\pounds 2\;\;\; 4\;\;\;11
\end{array}\right.
\qquad
14\left\{
\begin{array}{l}
\quad\; \pounds \quad s. \quad d. \\
7)\overline{5\;\;\;2\;\;\;1} \\
2)\overline{\;\;\;14\;\;\;7} \\
\qquad \overline{\;7\quad 3\tfrac{1}{2}} \\
\qquad\quad\;\; 9 \\
\pounds 3\;\;\; 5\;\;\;7\tfrac{1}{2}
\end{array}\right.
$$

$\pounds 3\;5s.\;7\tfrac{1}{2}d. - \pounds 2\;4s.\;11d. = \pounds 1\;0s.\;8\tfrac{1}{2}d.$

(8)...        ·1125 of 7 sov. = 15s. 9d.
               7
           ·7875 of 1 sov.                12) 9
               20                        21)15·75
           ‾‾‾‾‾‾‾                     15s. 9d. ══   ‾‾‾‾‾‾
           15·7500s.                                 ·75 of a guinea
               12
           ‾‾‾‾‾‾‾
           9·0000d.


                                          £   s.   d.
(9)...        112 lb. at 5½d.·per lb. =   2  11    4
                      cost per cwt. =     2   6    8
                                        ‾‾‾‾‾‾‾‾‾‾‾‾‾
                    profit per cwt. =         4    8

    £  s.  d.      s.  d.
    2  6  8   :    4   8  :: 100  :  10 per cent.


                                        £
(10)...        3½   :   83½  ::  175  :  x
               2         2
              ‾‾        ‾‾‾‾
               7         167

                              25
                       167 × 175
                x = ‾‾‾‾‾‾‾‾‾‾‾‾ = £4175
                           7
                           7


              *EXERCISE LXXVI.*

(1)...              3½ + 4¾ + 6¾ = 15
                    2s. 6d. ÷ 15 = 2d.

                                   s.   d.
                    2d. × 3½ =          7
                    2d. × 4¾ =          9½
                    2d. × 6¾ = 1        1½
                              ‾‾‾‾‾‾‾‾‾‾‾‾
                                   2s. 6d.

(2)...
$$5\tfrac{1}{4}+7\tfrac{1}{2}+8\tfrac{1}{4}+9 = 30$$
$$10s.\div 30 = 4d.$$

$$
\begin{array}{rcl}
& & s. \quad d. \\
4d. \times 5\tfrac{1}{4} & = & 1 \quad 9 \\
4d. \times 7\tfrac{1}{2} & = & 2 \quad 6 \\
4d. \times 8\tfrac{1}{4} & = & 2 \quad 9 \\
4d. \times 9 & = & 3 \quad 0 \\
\hline
& & \overline{10s. \ 0d.}
\end{array}
$$

(3)...
$$
\begin{array}{rrr}
£ & s. & d. \\
5)38 & 3 & 9 \\
\hline
7 & 12 & 9 \\
& & 13 \\
\hline
£99 & 5 & 9
\end{array}
$$

(4)...1.
| qrs. | lb. | | £ | s. | d. | |
|---|---|---|---|---|---|---|
| 2 | 0 | $= \tfrac{1}{2}$ of 1 cwt. | 3 | 10 | 0 | per cwt. |
| | | | | | 19 | |
| | | | 66 | 10 | 0 | |
| 1 | 0 | $= \tfrac{1}{2}$ of 2 qrs. | 1 | 15 | 0 | |
| | 14 | $= \tfrac{1}{2}$ of 1 qr. | | 17 | 6 | |
| | 7 | $= \tfrac{1}{2}$ of 14 lb. | | 8 | 9 | |
| | $3\tfrac{1}{2}$ | $= \tfrac{1}{2}$ of 7 lb. | | 4 | $4\tfrac{1}{2}$ | |
| | | | | 2 | $2\tfrac{1}{4}$ | |
| | | | £69 | 17 | $9\tfrac{3}{4}$ | |

2.
| | | £ | s. | d. | |
|---|---|---|---|---|---|
| 4 bu. $= \tfrac{1}{2}$ of 1 qr. | | 3 | 12 | 0 | per quarter |
| | | | | 9 | |
| | | 32 | 8 | 0 | |
| 1 bu. $= \tfrac{1}{4}$ of 4 bu. | | 1 | 16 | 0 | |
| 2 pks. $= \tfrac{1}{2}$ of 1 bu. | | | 9 | 0 | |
| 1 pk. $= \tfrac{1}{2}$ of 2 pks. | | | 4 | 6 | |
| | | | 2 | 3 | |
| | | £34 | 19 | 9 | |

3.　　2 ro. = ½ of 1 acre

$$
\begin{array}{rrr}
\pounds & s. & d. \\
2 & 2 & 0 \text{ per acre} \\
& & 9 \times 9 = 81 \\
\hline
18 & 18 & 0 \\
& & 9 \\
\hline
170 & 2 & 0
\end{array}
$$

1 ro. = ½ of 2 roods　　1　1　0
20 per. = ½ of 1 rood　　　10　6
5 per. = ¼ of 20 per.　　　5　3
　　　　　　　　　　　　　1　3¾
　　　　　　　£172　0　0¾

4.　qrs. na.
　　2　2 = ½ of 1 ell

$$
\begin{array}{rr}
s. & d. \\
12 & 6 \text{ per ell}
\end{array}
$$

　　1　0 = ⅙ of 1 ell　　　　11
　　　　　　　　　　　6　17　6
　　　　　　　　　　　　6　3
　　　　　　　　　　　　2　6
　　　　　　　　　£7　6　3

(5)...　　$7\frac{11}{12} + 5\frac{4}{9} = 7\frac{33}{36} + 5\frac{16}{36} = 13\frac{13}{36}$

$7\frac{11}{12} - 5\frac{4}{9} = 7\frac{33}{36} - 5\frac{16}{36} = 2\frac{17}{36}$

$13\frac{13}{36} \times 2\frac{17}{36} = \frac{481}{36} \times \frac{89}{36} = \frac{42809}{1296} = 33\frac{41}{1296}$

(6)...　cwt.
　·09375 = 10 lb. 8 oz.
　　　4
　·37500
　　28
　10·50000 lb.
　　16
　8·00000 oz.

4) 1
12)11·25
21) 3·9375
3s. 11¼d. = ·1875 of a guinea

$$
\begin{array}{ll}
\text{sov.} & \text{gui.}\\
(7)\dots\quad \cdot 265625 = 5s.\ 3\tfrac{3}{4}d. & \cdot 4375 = 9s.\ 2\tfrac{1}{4}d.\\
\qquad\quad 20 & \qquad 21\\
\hline
\qquad 5\cdot 312500s. & 9\cdot 1875s.\\
\qquad\quad 12 & \qquad 12\\
\hline
\qquad 3\cdot 750000d. & 2\cdot 2500d.\\
\qquad\quad 4 & \qquad 4\\
\hline
\qquad 3\cdot 000000\ \text{far.} & 1\cdot 0000\ \text{far.}
\end{array}
$$

$$
\begin{array}{rr}
s. & d.\\
9 & 2\tfrac{1}{4}\\
5 & 3\tfrac{3}{4}\\
\hline
3 & 10\tfrac{1}{2}
\end{array}
$$

$$
\begin{array}{l}
(8)\dots 2\tfrac{1}{2}\text{ per cent.} = \tfrac{1}{40}\text{ of }100\\
\quad 1\tfrac{1}{4}\ ,,\quad ,,\ = \tfrac{1}{2}\text{ of }2\tfrac{1}{2}
\end{array}
\left|
\begin{array}{rrr}
£ & s. & d.\\
397 & 16 & 8\\
9 & 18 & 11\\
4 & 19 & 5\tfrac{1}{2}\\
\hline
14 & 18 & 4\tfrac{1}{2}\ \text{interest for 1 year}\\
& & 3\\
\hline
44 & 15 & 1\tfrac{1}{2}
\end{array}
\right.
$$

$$
\begin{array}{lrrr}
6\text{ mo.} = \tfrac{1}{2}\text{ of }1\text{ yr.} = & 7 & 9 & 2\tfrac{1}{4}\\
4\text{ mo.} = \tfrac{1}{3}\ ,,\quad ,, \ = & 4 & 19 & 5\tfrac{1}{2}\\
\hline
& £57 & 3 & 9\tfrac{1}{4}\ \text{int. for 3 yrs. 10 mo.}
\end{array}
$$

$$
(9)\dots\quad \begin{array}{ccccccc}
£ & & £ & & £ & s. & d.\\
82 & : & 4 & :: & 1422 & 3 & 9 & : \text{ income required}
\end{array}
$$

$$
\begin{array}{r}
20\\
\hline
28443\\
12\\
\hline
341325
\end{array}
$$

$$
\textbf{annual income} = \frac{4 \times \cancel{341325}}{\cancel{82}} = 16650d. = £69\ 7s.\ 6d.
$$

| cwt. | qrs. | lb. | mi. | | cwt. | qr. | lb. | mi. | | *s.* | *d.* | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| )... | 2 | 3 | 14 × 126 | : | 7 | 1 | 16 × 140 | :: | 13 | 5 | : | $x$ |

$$
\begin{array}{ccc}
2\;3\;14 & 7\;1\;16 & 13\;5 \\
4 & 4 & 12 \\
\overline{11} & \overline{29} & \overline{161} \\
28 & 28 & \\
\overline{322} & \overline{828} & \\
\end{array}
$$

$$
\begin{array}{c}
10 \\
46 \quad 20
\end{array}
$$

$$x = \frac{\cancel{828} \times \cancel{140} \times \cancel{161}}{\cancel{322} \times \cancel{126}} = 460d. = £1\ 18s.\ 4d.$$

## EXERCISE LXXVII.

(1)...

|  |  |  | | *s.* | *d.* |
|---|---|---|---|---|---|
| 1 | lb. of | Tea | ............ = | 4 | 8 |
| $3\frac{1}{2}$ | ,, | Coffee | ............ = | 4 | 8 |
| $1\frac{3}{4}$ | ,, | do. | ............ = | 2 | 4 |
| 4 | ,, | Lump sugar | ... = | 2 | 4 |
| $2\frac{1}{2}$ | ,, | do. do. | ... = | 1 | $5\frac{1}{2}$ |
| $3\frac{1}{2}$ | ,, | Moist do. | ... = | 1 | $5\frac{1}{2}$ |
| 7 | ,, | do. do. | ... = | 2 | 11 |
| 10 | ,, | Rice | ............ = | 2 | 11 |
| 1 | ,, | do. | ............ = | | $3\frac{1}{2}$ |

(2)...

| | £ | s. | d. | |
|---|---|---|---|---|
| 2 roods = $\frac{1}{2}$ of 1 acre | 2 | 2 | 0 | per acre |
| | | | 125 | |
| | 262 | 10 | 0 | |
| 20 per. = $\frac{1}{4}$ of 2 ro. | 1 | 1 | 0 | |
| | 0 | 5 | 3 | |
| | £263 | 16 | 3 | |

(3)...

$$53\frac{1}{7} \div 3\frac{7}{8} = \frac{\overset{12}{\cancel{372}}}{7} \times \frac{8}{\cancel{31}} = \frac{96}{7} = 13\frac{5}{7}$$

(4)...
$$11s.\ 10\tfrac{1}{2}d. = 285 \text{ halfpence}$$
$$\pounds 1 = 480 \quad ,,$$
$$\tfrac{285}{480} \div \tfrac{15}{15} = \tfrac{19}{32} \text{ of } \pounds 1$$

$$4)1$$
$$12)\overline{2 \cdot 25}$$
$$21)\overline{9 \cdot 1875}$$

$$9s.\ 2\tfrac{1}{4}d. = \overline{\cdot 4375} \text{ of a guinea}$$

(5)... **From Monday, 4 P.M., to Friday, noon = 92 hours**

$$
\begin{array}{cccccccc}
\text{hrs.} & & \text{hrs.} & & \text{min.} & \text{sec.} & & \\
24 & : & 92 & :: & 4 & 45 & : & x \\
& & & & & 60 & & \\
\hline
& & & & \overline{285} & & &
\end{array}
$$

$$x = \dfrac{\overset{23}{\cancel{92}} \times \overset{95}{\cancel{285}}}{\underset{\substack{\cancel{6} \\ 2}}{\cancel{24}}} = \dfrac{2185}{2} = 1092\tfrac{1}{2} \text{ sec.} = 18 \text{ min. } 12\tfrac{1}{2} \text{ sec.}$$

∴ the clock will show 18 min. 12½ sec. past 12

(6)...
$$
\begin{array}{cccccccc}
\text{hor.} & \text{da.} & & \text{hor.} & \text{da.} & & \text{qrs.} & \\
800 \times 20 & & : & 860 \times 112 & & :: & 375 & : & x
\end{array}
$$

$$x = \dfrac{\overset{43}{\cancel{860}} \times \overset{7}{\cancel{112}} \times \overset{15}{\cancel{375}}}{\underset{\substack{\cancel{32} \\ 2}}{\cancel{800} \times \cancel{20}}} = \dfrac{4515}{2} \text{ qrs.} = 2257\tfrac{1}{2} \text{ qrs.}$$

(7)...
$$
\begin{array}{rrr}
\pounds & s. & d. \\
602 & 17 & 6 \text{ amount} \\
520 & 0 & 0 \text{ principal} \\
\hline
\pounds 82 & 17 & 6 \text{ interest for } 3\tfrac{3}{4} \text{ years}
\end{array}
$$

$$\pounds 82\ 17s.\ 6d. \div 3\tfrac{3}{4} = \pounds 22\ 2s. \text{ interest for 1 year}$$

$$
\begin{array}{cccccccc}
\pounds & & \pounds & & \pounds & s. & & \\
520 & : & 100 & :: & 22 & 2 & : & x \\
& & & & & 20 & & \\
\hline
& & & & \overline{442} & & &
\end{array}
$$

$$x = \dfrac{\overset{5}{\cancel{100}} \times \overset{17}{\cancel{442}}}{\underset{\substack{\cancel{520} \\ \cancel{20}}}{}} = 85s. = \pounds 4\tfrac{1}{4} \text{ per cent.}$$

M 2

(8)...    Loss on sale of £100 stock = $83\frac{5}{8} - 79\frac{3}{4} = £3\frac{7}{8}$

Total loss = $£3\frac{7}{8} \times 25 = £96\frac{7}{8} = £96$ 17s. 6d.

(9)...

```
        100
         10                    £   s.
        ‾‾‾‾
        1̶1̶0̶  :   1̶0̶0̶  ::   74   5
         11       10              10
                            ‾‾‾‾‾‾‾‾‾‾
                        11)742 10
        cost of 36 sheep  £67 10
```

cost of each sheep = £67 10s. ÷ 36 = £1 17s. 6d.

(10)...
```
     £          £          £   s.  d.
   2625   :   3250   ::   377   6  10½   :   B's share
                          20
                        ‾‾‾‾‾‾
                        7546
                          12
                        ‾‾‾‾‾‾
                        90562
                           4
                        ‾‾‾‾‾‾‾
                       362250
```

B's share = $\dfrac{\overset{26}{\cancel{3250}} \times \overset{17250}{\cancel{362250}}}{\underset{\cancel{21}}{\cancel{2625}}}$ = 448500 far. = £467 3s. 9d.

```
     £          £          far.
   2625   :   4825   ::   362250   :   C's share
```

C's share = $\dfrac{\overset{193}{\cancel{4825}} \times \overset{3450}{\cancel{362250}}}{\underset{\cancel{105}}{\cancel{2625}}}$ = 665850 far. = £693 11s. 7

## EXERCISE LXXVIII.

(1)...

| | | | s. | d. | £ | s. | d. |
|---|---|---|---|---|---|---|---|
| $19\frac{1}{2}$ yds. | Calico | ............ | 0 | $7\frac{1}{2}$ | = 0 | 12 | $2\frac{1}{4}$ |
| $16\frac{3}{4}$ | „ Flannel | ......... | 1 | 2 | = 0 | 19 | $6\frac{1}{2}$ |
| $11\frac{1}{2}$ | „ Bro. Holland | ... | 0 | 10 | = 0 | 9 | 7 |
| $15\frac{1}{4}$ | „ Print | ............ | 0 | $8\frac{1}{2}$ | = 0 | 10 | $11\frac{3}{4}$ |
| $3\frac{3}{4}$ | „ Book Muslin | ... | 1 | 6 | = 0 | 5 | $7\frac{1}{4}$ |
| $17\frac{1}{2}$ | „ Irish Linen | ...... | 1 | 3 | = 1 | 1 | $10\frac{1}{2}$ |
| $13\frac{1}{4}$ | „ Sheeting | ......... | 1 | 5 | = 0 | 18 | $9\frac{1}{4}$ |
| 9 | „ Ribbon | ......... | 0 | $7\frac{3}{4}$ | = 0 | 5 | $9\frac{3}{4}$ |
| $10\frac{1}{2}$ | „ do. | ......... | 0 | $4\frac{1}{2}$ | = 0 | 3 | $11\frac{1}{4}$ |
| | | | | | £5 | 8 | $3\frac{3}{4}$ |

(2)...

$$
18\frac{3}{4}\times 4 = 75 \begin{cases} \begin{array}{r} \quad\;\; £\quad s.\quad d. \\ 295\quad 1\quad 6\frac{3}{4} \\ 4 \\ \hline 5)\overline{1180\quad 6\quad 3} \\ 5)\overline{236\quad 1\quad 3} \\ 3)\overline{47\quad 4\quad 3} \\ \hline £15\quad 14\quad 9 \end{array} \end{cases}
$$

(3)...

$$
\begin{array}{c}
\text{qrs.}\quad\text{bu.}\quad\text{pks.}\quad\text{gal.} \\
19\quad 3\quad 2\quad 1 \\
8\times 7+1 = 57 \\
\hline
155\quad 5\quad 0\quad 0 \\
7 \\
\hline
1089\quad 3\quad 0\quad 0 \\
19\quad 3\quad 2\quad 1 \\
\hline
1108\quad 6\quad 2\quad 1
\end{array}
$$

4)...

$$
(1\tfrac{2}{9})^2\times(2\tfrac{1}{4})^3 = \frac{11}{9}\times\frac{11}{9}\times\frac{9}{4}\times\frac{9}{4}\times\frac{9}{4} = \frac{1089}{64} = 17\frac{1}{64}
$$

(5)...  $(\tfrac{11}{15} \text{ of } \tfrac{9}{10} \text{ of } 6\tfrac{5}{6}) \div (\tfrac{7}{8} \text{ of } 1\tfrac{1}{2} \text{ of } 3\tfrac{1}{2})$

$$= \frac{11}{15} \times \frac{9}{10} \times \frac{41}{6} \times \frac{8}{7} \times \frac{12}{11} \times \frac{5}{16}$$

$$= \tfrac{123}{70} = 1\tfrac{53}{70};$$

$$\frac{7}{12} \text{ of } \frac{9}{14} \text{ of } 17 = \frac{7}{12} \times \frac{9}{14} \times \frac{17}{1} = \frac{51}{8} = 6\tfrac{3}{8}$$

$$\frac{8}{9} \text{ of } \frac{15}{16} \text{ of } 25\tfrac{1}{2} = \frac{8}{9} \times \frac{15}{16} \times \frac{51}{2} = \frac{85}{4} = 21\tfrac{1}{4}$$

$$21\tfrac{1}{4} - 6\tfrac{3}{8} = 21\tfrac{2}{8} - 6\tfrac{3}{8} = 14\tfrac{7}{8}$$

(6)...  $$\frac{13}{24} \text{ hf. gui.} = \frac{13}{24} \times \frac{21}{2} = \frac{91}{16} = \quad \overset{s.}{5} \quad \overset{d.}{8\tfrac{1}{4}}$$

$$\frac{11}{32} \text{ sov.} = \frac{11}{32} \times \frac{20}{1} = \frac{55}{8} = \frac{6 \quad 10\tfrac{1}{2}}{12 \quad 6\tfrac{3}{4}}$$

$$\begin{array}{r} 4)\ 3 \\ \hline 12)\ 6{\cdot}75 \\ \hline 20)\overline{12{\cdot}5625} \\ \hline 5)\ \ \overline{{\cdot}628125} \\ \hline \end{array}$$

$$12s.\ 6\tfrac{3}{4}d. = \ \cdot125625 \text{ of } £5$$

(7)...  $$\overset{\text{yds.}}{7\tfrac{7}{10}} \ : \ \overset{\text{yds.}}{19\tfrac{9}{16}} \ :: \ \overset{£}{1\tfrac{37}{40}} \ : \ x$$

$$x = \frac{10}{77} \times \frac{313}{16} \times \frac{77}{40} = £\frac{313}{64} = £4 \ 17s. \ 9\tfrac{3}{4}d.$$

(8)... £527 10s. + £753 15s. + £815 15s. = £2097

$$
\begin{array}{ccccccc}
£ & & £ & s. & & £ & s. \\
2097 & : & 527 & 10 & :: & 873 & 15 & : & \text{A's portion} \\
2 & & 2 & & & & 20 \\
\hline
4194 & & 1055 & & & 17475
\end{array}
$$

A's portion $= \dfrac{1055 \times \overset{25}{\cancel{17475}}}{\underset{6}{\cancel{4194}}} = \dfrac{26375}{6}s. = £219\ 15s.\ 10d.$

$$
\begin{array}{ccccccc}
£ & & £ & s. & & s. \\
2097 & : & 753 & 15 & :: & 17475 & : & \text{B's portion} \\
4 & & 4 \\
\hline
8388 & & 3015
\end{array}
$$

B's portion $= \dfrac{\overset{1005}{\cancel{3015}} \times \overset{25}{\cancel{17475}}}{\underset{\underset{4}{12}}{\cancel{8388}}} = \dfrac{25125}{4}s. = £314\ 1s.\ 3d.$

$$
\begin{array}{ccccccc}
£ & & £ & s. & & s. \\
2097 & : & 815 & 15 & :: & 17475 & : & \text{C's portion} \\
4 & & 4 \\
\hline
8388 & & 3263
\end{array}
$$

C's portion $= \dfrac{3263 \times \overset{25}{\cancel{17475}}}{\underset{12}{\cancel{8388}}} = \dfrac{81575}{12}s. = £339\ 17s.\ 11d.$

$$
\begin{array}{ccccccc}
£ & & £ & & s. \\
2097 & : & 1 & :: & 17475 & : & \text{dividend}
\end{array}
$$

dividend $= \frac{17475}{2097} = \frac{25}{3}s. = 8s.\ 4d.$ in the pound

$$
\begin{array}{llll}
 & s. & d. & \pounds\ s.\ d. \\
(9)... & 45 \text{ gallons at } 15 & 0 = 33\ 15\ 0 \\
 & 63\ \text{,,}\quad\text{,, } 17 & 6 = 55\ \ 2\ 6 \\
 & \underline{75}\ \text{,,}\quad\text{,, } 18 & 6 = 69\ \ 7\ 6 \\
 & \overline{183} & \pounds\overline{158\ \ 5\ 0}
\end{array}
$$

183 gallons $= 91\frac{1}{2}$ dozen

$$
\begin{array}{lll}
 & \pounds & s.\ d. \\
91\frac{1}{2} \text{ doz. at } \pounds2\ 2s. = & 192. & 3\ \ 0 \\
\text{cost} & 158 & 5\ \ 0 \\
\text{profit} \pounds\overline{33} & \overline{18} & \overline{0}
\end{array}
$$

(10)...1 sov. $+$ 3 hf. cr. $+$ 5s. $= \pounds1$ 12s. 6d. $=$ 13 hf. cr.

$\pounds81$ 5s. $=$ 650 hf. cr.

$650 \div 13 = 50$

50 sovereigns

$50 \times 3 = 150$ half crowns

$50 \times 5 = 250$ shillings

## EXERCISE LXXIX.

$$
\begin{array}{llrrr}
 & & \pounds & s. & d. \\
27\frac{1}{2} & \text{gui.} & = 28 & 17 & 6 \\
36 & \text{sov.} & = 36 & 0 & 0 \\
43 & \text{cr.} & = 10 & 15 & 0 \\
77 & \text{hf. cr.} & = 9 & 12 & 6 \\
69 & \text{fl.} & = 6 & 18 & 0 \\
237 & \text{sh.} & = 11 & 17 & 0 \\
143 & \text{sixp.} & = 3 & 11 & 6 \\
 & & \pounds\overline{107} & \overline{11} & \overline{6}
\end{array}
$$

$$
\begin{array}{lrrr}
 & \text{cwt.} & \text{qrs.} & \text{lb.} \\
(2)...3 & 2 & 23\frac{1}{2} \\
 & & & 6 \times 3 = \\
\overline{22} & \overline{1} & \overline{1} \\
 & & 3 \\
\overline{66} & \overline{3} & \overline{3} \\
4 \\
\overline{267} \\
28 \\
\overline{7479} \text{ lb.}
\end{array}
$$

$$
\begin{array}{llrll}
\text{ac.} & \text{ro.} & \text{po.} & \text{ac.} \ \text{ro.} \ \text{po.} & \pounds\ \ s.\ \ d. \\
(3)...237 & 3 & 20 & :\quad 315\ \ 1\ \ 30 & ::\quad 523\ \ 6\ \ 6\quad : \\
\underline{4} & & & \underline{\ \ 4} & \underline{\ \ 20} \\
\overline{951} & & & \overline{1261} & \overline{10466} \\
\underline{40} & & & \underline{\ \ 40} & \underline{\ \ 12} \\
\overline{38060} & & & \overline{50470} & \overline{125598}
\end{array}
$$

$$
x = \frac{\overset{5047}{\cancel{50470}} \times \overset{33}{\cancel{125598}}}{\underset{\cancel{3808}}{\cancel{38060}}} = 166551d. = \pounds693\ 19s.\ 3d.
$$

(4)...From June 7th to December 20th=196 days=28 weeks

$$
\begin{array}{rrrr}
 & \pounds & s. & d. \\
\text{cost of pig} = & 1 & 5 & 0 \\
\text{28 weeks' keep, at } 2s.\ 3d.\text{ per week} = & 3 & 3 & 0 \\
\hline
\text{total cost} = \pounds 4 & 8 & 0
\end{array}
$$

$$
\begin{array}{rrrr}
 & \pounds & s. & d. \\
\text{235 lb. at } 6\frac{1}{2}d.\text{ per lb.} = & 6 & 7 & 3\frac{1}{2} \\
 & 4 & 8 & 0 \\
\hline
\text{profit} = \pounds 1 & 19 & 3\frac{1}{2}
\end{array}
$$

(5)...
| s. | d. | | £ | s. | d. | |
|---|---|---|---|---|---|---|
| 10 | 0 | $=\frac{1}{2}$ of £1 | 2375 | 0 | 0 | = value at £1 each |
| 5 | 0 | $=\frac{1}{2}$ of 10s. | 1187 | 10 | 0 | |
| 1 | 8 | $=\frac{1}{3}$ of 5s. | 593 | 15 | 0 | |
| 2$\frac{1}{2}$ | | $=\frac{1}{8}$ of 1s. 8d. | 197 | 18 | 4 | |
| $\frac{1}{4}$ | | $=\frac{1}{10}$ of 2$\frac{1}{2}$d. | 24 | 14 | 9$\frac{1}{2}$ | |
| | | | 2 | 9 | 5$\frac{3}{4}$ | |
| | | | £2006 | 7 | 7$\frac{1}{4}$ | |

| s. | d. | | £ | s. | d. | |
|---|---|---|---|---|---|---|
| 10 | 0 | $=\frac{1}{2}$ of £1 | 5329 | 0 | 0 | = value at £1 each |
| 5 | 0 | $=\frac{1}{2}$ of 10s. | 2664 | 10 | 0 | |
| 2 | 6 | $=\frac{1}{2}$ of 5s. | 1332 | 5 | 0 | |
| 1 | 3 | $=\frac{1}{2}$ of 2s. 6d. | 666 | 2 | 6 | |
| | $\frac{1}{2}$ | $=\frac{1}{30}$ of 1s. 3d. | 333 | 1 | 3 | |
| | | | 11 | 2 | 0$\frac{1}{2}$ | |
| | | | £5007 | 0 | 9$\frac{1}{2}$ | |

| s. | d. | | £ | s. | d. | |
|---|---|---|---|---|---|---|
| 10 | 0 | $=\frac{1}{2}$ of £1 | 1437 | 0 | 0 | = value at £1 each |
| | | | | | 2 | |
| | | | 2874 | 0 | 0 | |
| 3 | 4 | $=\frac{1}{3}$ of 10s. | 718 | 10 | 0 | |
| | 4 | $=\frac{1}{10}$ of 3s. 4d. | 239 | 10 | 0 | |
| | $\frac{1}{2}$ | $=\frac{1}{8}$ of 4d. | 23 | 19 | 0 | |
| | | | 2 | 19 | 10$\frac{1}{2}$ | |
| | | | £3858 | 18 | 10$\frac{1}{2}$ | |

(6)...1.

$$5\tfrac{5}{9} \text{ of } 6\tfrac{3}{10} = \frac{\overset{5}{\cancel{50}}}{\cancel{9}} \times \frac{\overset{7}{\cancel{63}}}{\cancel{10}} = 35$$

$$6\tfrac{1}{9} - 3\tfrac{7}{12} = 6\tfrac{4}{36} - 3\tfrac{21}{36} = 2\tfrac{19}{36}$$

$$35 \div 2\tfrac{19}{36} = \frac{\overset{5}{\cancel{35}}}{1} \times \frac{36}{\underset{13}{\cancel{91}}} = \frac{180}{13} = 13\tfrac{11}{13}$$

2.   $\dfrac{4\frac{2}{7}}{11\frac{2}{3}} = \dfrac{\frac{30}{7}}{\frac{35}{3}} = \dfrac{\overset{6}{\cancel{30}} \times 3}{\underset{7}{\cancel{35}} \times 7} = \dfrac{18}{49}$ ;   $\dfrac{1\frac{5}{8}}{7\frac{2}{9}} = \dfrac{\frac{13}{8}}{\frac{65}{9}} = \dfrac{\cancel{13} \times 9}{\underset{5}{\cancel{65}} \times 8} = \dfrac{9}{40}$ ;

$$\frac{8\frac{3}{5}}{7\frac{9}{11}} = \frac{\frac{43}{5}}{\frac{86}{11}} = \frac{\cancel{43} \times 11}{\underset{2}{\cancel{86}} \times 5} = \frac{11}{10}$$

$$\therefore \; \frac{4\frac{2}{7}}{11\frac{2}{3}} - \frac{1\frac{5}{8}}{7\frac{2}{9}} + \frac{8\frac{3}{5}}{7\frac{9}{11}} = \frac{18}{19} - \frac{9}{40} + \frac{11}{10}$$

$$= \frac{720 - 441 + 2156}{1960}$$

$$= \tfrac{2435}{1960}$$

$$= \tfrac{487}{392} = 1\tfrac{95}{392}$$

3.     $7{\cdot}045 = 7\tfrac{45}{1000} = 7\tfrac{9}{200}$ ;   $8{\cdot}0625 = 8\tfrac{625}{10000} = 8\tfrac{1}{16}$

$\therefore$     $7{\cdot}045 - 5\tfrac{7}{32} + 8{\cdot}0625 - 4\tfrac{11}{20}$

$= 7\tfrac{9}{200} - 5\tfrac{7}{32} + 8\tfrac{1}{16} - 4\tfrac{11}{20}$

$= 7\tfrac{36}{800} - 5\tfrac{175}{800} + 8\tfrac{50}{800} - 4\tfrac{440}{800}$

$= 15\tfrac{86}{800} - 9\tfrac{615}{800}$

$= 5\tfrac{271}{800} = 5{\cdot}33875$

(7)...

$$\frac{31}{36}\text{ gui.} = \frac{31}{\overset{}{\cancel{36}}}\times\frac{\overset{7}{\cancel{21}}}{1} = \frac{217}{12} = 18s.\ 1d.$$
$$\underset{12}{}$$

$$\frac{27}{40}\text{ hf. cr.} = \frac{27}{\underset{8}{\cancel{40}}}\times\frac{\overset{}{\cancel{5}}}{2} = \frac{27}{16} = 1s.\ 8\tfrac{1}{4}d.$$

sov.
·2875 = 5s. 9d.
20
‾‾‾‾‾
5·7500s.
12
‾‾‾‾‾
9·0000d.

fl.
·6875 = 1s. 4½d.
2
‾‾‾‾‾
1·3750s.
12
‾‾‾‾‾
4·5000d.
4
‾‾‾‾‾
2·0000 far.

|  | £ | s. | d. |
|---|---|---|---|
| $\frac{31}{36}$ gui. = | 0 | 18 | 1 |
| ·2875 sov. = | 0 | 5 | 9 |
| $\frac{27}{40}$ hf. cr. = | 0 | 1 | $8\frac{1}{4}$ |
| ·6875 flo. = | 0 | 1 | $4\frac{1}{2}$ |
|  | £1 | 6 | $10\frac{3}{4}$ |

(8)...

cwt.          cwt.               £
5·6875   :   9·8125   ::   23·8875   :   x

$$x = \frac{9\cdot8125 \times \overset{4\cdot2}{\cancel{23\cdot8875}}}{\cancel{5\cdot6875}} = £41\cdot2125 = £41\ 4s.\ 3d.$$

(9)...From March 25 to August 18 = 146 days = $\frac{2}{5}$ of a year

4 per cent.= $\frac{1}{25}$ of 100)725 12 6

        )29 0 6 = 1 year's int.
        ‾‾‾‾‾‾‾‾‾
        5 16 $1\frac{1}{5}$
        2

£11 12 $2\frac{2}{5}$ = 146 days' int.

$$\begin{array}{ccc} \text{£} & s. & d. \end{array}$$

(10)...
$$\begin{array}{rrl} 166 & 18 & 11\frac{1}{2} \text{ amount} \\ 156 & 13 & 4 \text{ principal} \\ \hline \text{£}10 & 5 & 7\frac{1}{2} \text{ interest} \end{array}$$

$$\begin{array}{ccc} \text{£} & s. & d. \end{array}$$
$$\begin{array}{lll} 2\frac{1}{2} \text{ per cent.} = \frac{1}{40} \text{ of } 100 & 156 & 13 & 4 \\ 1\frac{1}{4} \ „ \quad „ \ = \frac{1}{2} \text{ of } 2\frac{1}{2} & 3 & 18 & 4 \\ & 1 & 19 & 2 \\ \hline & \text{£}5 & 17 & 6 = 1 \text{ year's int.} \end{array}$$

$$\begin{array}{ccc} \text{£} & s. & d. \end{array} \quad \begin{array}{ccc} \text{£} & s. & d. \end{array} \qquad \text{yr.} \qquad \text{yr.}$$
$$5 \ \ 17 \ \ 6 \ \ : \ \ 10 \ \ 5 \ \ 7\frac{1}{2} \ \ :: \ \ 1 \ \ : \ \ 1\frac{3}{4}$$


## EXERCISE LXXX.

(1)...
$$\text{£}100 = 48000 \text{ halfpence}$$
$$3s. \ 1\frac{1}{2}d. = 75 \text{ halfpence}$$

$$48000 \div 75 = 640 \text{ days} = 1 \text{ year } 275 \text{ days}$$


(2)...     $22\frac{1}{2}$ lb. $\times 70 = 1575$ lb. $= 14$ cwt. $7$ lb.

$$\begin{array}{ccc} \text{£} & s. & d. \end{array}$$
$$\begin{array}{rrr} 2 & 13 & 8 \\ & & 14 \\ \hline 37 & 11 & 4 \\ 7 \text{ lb.} = \quad 3 & 4\frac{1}{2} \\ \hline \text{£}37 & 14 & 8\frac{1}{4} \end{array}$$

$$\begin{array}{ccc} & \text{£} & s. & d. \end{array}$$
$$\begin{array}{lrrr} 1575 \text{ lb. at } 6\frac{1}{2}d. \text{ per lb.} = & 42 & 13 & 1\frac{1}{2} \\ \text{cost} = & 37 & 14 & 8\frac{1}{4} \\ \hline \text{profit} = & \text{£}4 & 18 & 5\frac{1}{4} \end{array}$$


(3)...     3500 eggs at 7 for $6d. = 500$ sixpences
$$= \text{£}12 \ 10s. \quad 0d.$$
3500 eggs at $6s.$ $6d.$ per $100 = \text{£}11 \ \ 7s. \quad 6d.$
$$\text{profit} = \overline{\text{£}1 \quad 2s. \quad 6d.}$$

(4)...  $$\tfrac{272}{338} \div \tfrac{18}{18} = \tfrac{17}{21}; \quad \tfrac{255}{391} \div \tfrac{17}{17} = \tfrac{15}{23};$$

$$\tfrac{608}{779} \div \tfrac{18}{18} = \tfrac{32}{41}; \quad \tfrac{5005}{7007} \div \tfrac{1001}{1001} = \tfrac{5}{7}$$

(5)...  $$3\tfrac{5}{9} + 4\tfrac{7}{15} + 7\tfrac{9}{20} + 9\tfrac{13}{25}$$

$$= 23 + \tfrac{5}{9} + \tfrac{7}{15} + \tfrac{9}{20} + \tfrac{13}{25}$$

$$= 23 + \frac{500 + 420 + 405 + 468}{900}$$

$$= 23 + \tfrac{1793}{900} = 23 + 1\tfrac{893}{900}$$

$$= 24\tfrac{893}{900}$$

(6). .  $$(\tfrac{5}{12} \text{ of } \tfrac{7}{10} \text{ of } 3\tfrac{1}{5}) \times (\tfrac{10}{21} \text{ of } \tfrac{7}{8} \text{ of } 4\tfrac{4}{5})$$

$$= \frac{\cancel{5}}{\cancel{12}_3} \times \frac{7}{\cancel{10}} \times \frac{\cancel{16}^4}{\cancel{5}} \times \frac{\cancel{10}}{\cancel{21}_3} \times \frac{7}{\cancel{8}} \times \frac{\cancel{24}^3}{5}$$

$$= \tfrac{28}{15} = 1\tfrac{13}{15}$$

$$(\tfrac{9}{10} \text{ of } \tfrac{7}{15} \text{ of } 7\tfrac{1}{3}) \div (\tfrac{11}{12} \text{ of } \tfrac{21}{20} \text{ of } 3\tfrac{3}{4})$$

$$= \frac{\cancel{9}}{\cancel{10}} \times \frac{7}{\cancel{15}_5} \times \frac{\cancel{22}^2}{\cancel{3}} \times \frac{\cancel{12}^4}{\cancel{11}} \times \frac{\cancel{20}^2}{\cancel{21}_3} \times \frac{4}{15} = \frac{64}{75}$$

(7)...  April contains 30 days

$$\frac{9}{20} \text{ of } 30 \text{ days} = \frac{9}{\cancel{20}_2} \times \frac{\cancel{30}^3}{1} = \frac{27}{2} = \overset{\text{da. ho. min.}}{13 \quad 12 \quad 0}$$

$$1\tfrac{1}{8} \text{ week} = \tfrac{11}{18} \times \tfrac{7}{1} = \tfrac{77}{18} = \begin{matrix} 4 & 6 & 40 \\ \hline 9 & 5 & 20 \end{matrix}$$

(8)...
| la. w. | la. w. | £ s. d. | £ s d |
|---|---|---|---|
| $11 \times 15$ | $13 \times x$ | 103 2 6 | 170 12 |
| | | 8 | 8 |
| | | $\overline{825}$ hf. cr. | $\overline{1365}$ hf. cr |

$$x = \frac{11 \times 15 \times 1365}{13 \times 825} = 21 \text{ weeks}$$

(9)...
$$19 + 24 + 29 = 72$$

$$72 \left\{ \begin{array}{l} 6)\overline{26 \quad 5 \quad 0} = 25 \text{ guineas} \\ \cdot 12)\overline{\;4 \quad 7 \quad 6} \end{array} \right.$$

$$\overline{7s. \; 3\tfrac{1}{2}d.}$$

|  | £ s. d. |
|---|---|
| $7s. \; 3\tfrac{1}{2}d. \times 19 =$ | 6 18 $6\tfrac{1}{2}$ |
| $7s. \; 3\tfrac{1}{2}d. \times 24 =$ | 8 15 0 |
| $7s. \; 3\tfrac{1}{2}d. \times 29 =$ | 10 11 $5\tfrac{1}{2}$ |
|  | £26 5 0 |

(10)... 28879876(5374      38254225(6185

| 25 | 36 |
|---|---|
| 103) $\overline{387}$ | 121) $\overline{225}$ |
| 309 | 121 |
| 1067) $\overline{7898}$ | 1228) $\overline{10442}$ |
| 7469 | 9824 |
| 10744) $\overline{42976}$ | 12365) $\overline{61825}$ |
| 42976 | 61825 |

## EXERCISE LXXXI.

(1)... 1.
| s. d. | £ s. d. |
|---|---|
| 5 0 = $\tfrac{1}{4}$ of £1 | 1735 0 0 = value at £1 |
| | 2 |
| | $\overline{3470 \quad 0 \quad 0}$ |
| 2 6 = $\tfrac{1}{2}$ of 5s. | 433 15 0 |
| 3 = $\tfrac{1}{10}$ of 2s. 6d. | 216 17 6 |
| | 21 13 9 |
| | £4142 6 3 |

|  |  | £ | s. | d. |  |
|---|---|---|---|---|---|
| 2. | 1 qr. = ¼ of 1 cwt. | 2 | 16 | 0 | per cwt. |
|  |  |  | 13 |  |  |
|  |  | 36 | 8 | 0 |  |
|  | 14 lb. = ½ of 1 qr. |  | 14 | 0 |  |
|  | 7 lb. = ½ of 14 lb. |  | 7 | 0 |  |
|  | 3½ lb. = ½ of 7 lb. |  | 3 | 6 |  |
|  |  |  | 1 | 9 |  |
|  |  | £37 | 14 | 3 |  |

cwt. qrs. lb.      £   s.   d.

3.  10  0  0 = ½ of 1 ton     9  10  0  per ton

                           5 × 10 = 50

                    47  10  0

                         10

                 475  0  0

      2  2  0 = ¼ of 10 cwt.  4  15  0

      1  1  0 = ½ of 2½ cwt.  1  3  9

          14 = $\frac{1}{10}$ of 1¼ cwt.  11  10¼

                        1  2¼

                 £481  11  9¾

s.   d.                 £    s.    d.          yds.

4.  2  6 = $\frac{1}{8}$ of £1   2347  0  0 = value of 2347 at £1

    1  3 = ½ of 2s. 6d.  293  7  6

      1 = $\frac{1}{15}$ of 1s. 3d.  146  13  9

                      9  15  7

    4 sq. ft. 72 sq. in. =    0  1  11

    1 sq. ft. 18 sq. in. =    0  0  5¾

                     £449  19  2¾

2)...               1 mile = 1760 yards

                        16¼

                    28160

                     440

           5720)28600(5 yards

               28600

|  | E. ells qrs. na. |  | yds. qr. na. |  | £ | s. | d. |
|---|---|---|---|---|---|---|---|
| (3)... | 29  3  2 | : | 47  1  3 | :: | 6 | 3 | 9 |
|  | 5 |  | 4 |  | 20 |  |  |
|  | $\overline{148}$ |  | $\overline{189}$ |  | $\overline{123}$ |  |  |
|  | 4 |  | 4 |  | 12 |  |  |
|  | $\overline{594}$ |  | $\overline{759}$ |  | $\overline{1485}$ |  |  |

$$x = \frac{759 \times \overset{5}{\cancel{1485}}}{\underset{2}{\cancel{594}}} = \frac{3795}{2}d. = £7 \ 18s. \ 1\tfrac{1}{2}d.$$

(4)...

$$\begin{array}{c} s. \quad d. \\ 38 \quad 8 \\ \underline{\quad\ 9} \\ 348 \quad 0 \\ 12 \\ \overline{4176} \\ \end{array}$$

$$hf.\,d. \quad 2$$
$$3s. \ 7\tfrac{1}{2}d. = 87)\overline{8352}(96 \text{ lb.}$$
$$\begin{array}{r} 783 \\ \overline{52\overline{2}} \\ 522 \\ \overline{\phantom{522}} \end{array}$$

(5)...   1.   $(7{\cdot}345 - 8{\cdot}944145 + 4{\cdot}06525) \div {\cdot}057$
$\qquad = \quad 2{\cdot}466105 \div {\cdot}057$
$\qquad = \quad 43{\cdot}265$

2.   $(791{\cdot}0981 \div 38{\cdot}515) \times {\cdot}00725$
$\qquad = 20{\cdot}54 \times {\cdot}00725$
$\qquad = {\cdot}148915$

(6)...
$$\frac{9}{10} \text{ fur.} = \frac{9}{\cancel{10}} \times \frac{\overset{22}{\cancel{220}}}{1} = \overset{\text{yds.}}{198}$$

$$\frac{3}{40} \text{ mi.} = \frac{3}{\cancel{40}} \times \frac{\overset{44}{\cancel{1760}}}{1} = \frac{132}{\overline{66 \text{ yards}}}$$

(7)...
$$\overset{s.}{20)2{\cdot}075}$$
$$\overline{{\cdot}10375} \text{ of a sov.}$$

(8)...      46090521(6789          97535376(9876
            36                     81
        127)1009               188)1653
            889                    1504
       1348)12005              1967)14953
            10784                   13769
      13569)122121           19746)118476
            122121                  118476

(9)...
$$7\tfrac{5}{13} \text{ ac.} \; : \; 19\tfrac{11}{16} \text{ ac.} \; :: \; 15\tfrac{23}{40} \text{ £} \; : \; x$$

$$x = \frac{12}{89} \times \frac{315}{16} \times \frac{623}{40} = £\frac{1323}{32} = £41 \; 6s. \; 10\tfrac{1}{2}d.$$

(10)...
$$\begin{array}{rr} £ & s. \\ 393 & 0 \quad \text{amount} \\ 327 & 10 \quad \text{principal} \\ \hline £65 & 10 \quad \text{interest} \end{array}$$

5 per cent. $= \tfrac{1}{20}$ of 100)327 10 0

£16 7 6 interest for 1 year

$$\begin{array}{ccc} £ \; s. \; d. & £ \; s. & yr. \quad yrs. \\ 16 \; 7 \; 6 \; : & 65 \; 10 \; :: & 1 \; : \; 4 \end{array}$$

## EXERCISE LXXXII.

(1)...
| cwt. | qrs. | lb. | | cwt. | qr. | lb. | | £ | s. | d. | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 7 | 2 | 18 | : | 9 | 1 | 25 | :: | 8 | 18 | 9 | : $x$ |
| 4 | | | | 4 | | | | 20 | | | |
| 30 | | | | 37 | | | | 178 | | | |
| 28 | | | | 28 | | | | 12 | | | |
| 858 | | | | 1061 | | | | 2145 | | | |

$$x = \frac{1061 \times 2145}{858} = \frac{5305}{2}d. = £11 \; 1s. \; 0\tfrac{1}{2}d.$$

N

$$\begin{array}{ccc} \pounds & s. & d. \\ 28 & 4 & 4\frac{1}{2} \end{array}$$

(2)...

$$\begin{array}{r} 20 \\ \hline 564 \\ 12 \\ \hline 7)6772\frac{1}{2} \\ \hline 967\frac{1}{2} = \pounds967\ 10s. \end{array}$$

(3)...   1 cwt. 2 qrs. 12 lb. × 75 = 180 lb. × 75 = 13500 lb.

$$\begin{array}{ccc} & \pounds & s. & d. \end{array}$$

1s. 3d. = $\frac{1}{16}$ of $\pounds$1   |13500  0  0 = value at $\pounds$1 per lb.
$\frac{1}{2}$d. = $\frac{1}{30}$ of 1s. 3d. | 843 15  0
                                            28  2  6
                                    -------------------
                                    $\pounds$871 17  6

(4)...

$$\begin{array}{ccccc} & & & & I.\ mi. \\ 11 & : & 14 & :: & 113 \\ & & & & 14 \\ & & & 11)\overline{1582} \\ & & & \overline{143\ mi.\ 6\ fur.\ 120\ yds.} \end{array}$$

(5)...   1 cwt. 2 qrs. 17$\frac{1}{2}$ lb. × 1250 = 103 t. 10 cwt. 1 qr. 7 lb.

$$\begin{array}{ll}
 & \pounds\quad s.\quad d. \\
10\ cwt. = \frac{1}{2}\ of\ 1\ ton & 4\ \ 15\ \ 0\ per\ ton \\
 & \qquad 10 \times 10 + 3 = 103 \\
 & \overline{47\ 10\ \ 0} \\
 & \qquad\ 10 \\
 & \overline{475\ \ 0\ \ 0} \\
 & 14\ \cdot\ 5\ \ 0 \\
1\ qr. = \frac{1}{40}\ of\ 10\ cwt. & 2\ \ 7\ \ 6 \\
7\ lb. = \frac{1}{4}\ of\ 1\ qr. & 0\ \ 1\ \ 2\frac{1}{4} \\
 & 0\ \ 0\ \ 3\frac{9}{16} \\
 & \overline{\pounds491\ 13\ 11\frac{13}{16}}
\end{array}$$

(6)...

$$
\begin{array}{ccc}
\pounds & s. & d. \\
23 & 1 & 8 \\
18 & 9 & 4 \\
\hline
\pounds4 & 12 & 4
\end{array} = \text{profit by sale of } 34\tfrac{5}{8} \text{ yards}
$$

$$
\begin{array}{ccccccc}
\text{yds.} & & \text{yd.} & & \pounds & s. & d. \\
34\tfrac{5}{8} & : & 1 & :: & 4 & 12 & 4 \quad : \quad \text{gain per yard} \\
8 & & 8 & & 20 \\
\hline
277 & & 8 & & 92 \\
& & & & 12 \\
& & & & \hline \\
& & & & 1108
\end{array}
$$

$$
\text{gain per yard} = \frac{8 \times \overset{4}{\cancel{1108}}}{\cancel{277}} = 32d. = 2s. \ 8d.
$$

(7)...

$$
\begin{array}{ccc}
\pounds & s. & d. \\
805 & 9 & 2 \ \text{amount} \\
619 & 11 & 8 \ \text{principal} \\
\hline
\pounds185 & 17 & 6 \ \text{interest}
\end{array}
$$

$$
\begin{array}{l}
2\tfrac{1}{2} \text{ per cent.} = \tfrac{1}{40} \text{ of } 100 \\
1\tfrac{1}{4} \quad \text{,,} \quad = \tfrac{1}{2} \text{ of } 2\tfrac{1}{2}
\end{array}
\left|
\begin{array}{ccc}
\pounds & s. & d. \\
619 & 11 & 8 \\
15 & 9 & 9\tfrac{1}{2} \\
7 & 14 & 10\tfrac{3}{4} \\
\hline
\pounds23 & 4 & 8\tfrac{1}{4}
\end{array}
\right| = \text{interest for 1 year}
$$

$$
\begin{array}{ccccccccccc}
\pounds & s. & d. & & \pounds & s. & d. & & \text{yr.} & & \text{yrs.} \\
23 & 4 & 8\tfrac{1}{4} & : & 185 & 17 & 6 & :: & 1 & : & 8
\end{array}
$$

(8)... Amount of £100 in $5\tfrac{1}{4}$ yrs. at $4\tfrac{1}{2}$ per cent. per annum

$$
= \pounds100 + (\pounds4 \ 10s. \times 5\tfrac{1}{4}) = \pounds123 \ 12s. \ 6d.
$$

$$
\begin{array}{ccccccccccc}
\pounds & s. & d. & & \pounds & s. & d. & & \pounds \\
123 & 12 & 6 & : & 585 & 3 & 2 & :: & 100 & : & \pounds473 \ 6s. \ 8d.
\end{array}
$$

N 2

$$\text{men wks.} \qquad \text{men wks.} \qquad \text{ca. lb.} \qquad \text{ca. lb.}$$

(9)...   $18 \times 16 \times 1 \;:\; 24 \times x \times \frac{4}{5} \;::\; 42 \times 60 \;:\; 48 \times 70$

$$x = \frac{18 \times 16 \times 48 \times 70}{24 \times \frac{4}{5} \times 42 \times 60} = 20 \text{ weeks}$$

(10)...  If $x$      $=$ no. of votes for successful candidate

$$\left. \begin{array}{l} x - 269 \\ x - 313 \\ x - 857 \end{array} \right\} = \text{nos. for the other candidates}$$

Now $\overline{4x - 1439} = 7949$

$\therefore 4x = 7949 + 1439 = 9388$

and   $x = 2347$, no. for successful candidate

$$x - 269 = 2347 - 269 = 2078$$
$$x - 313 = 2347 - 313 = 2034$$
$$x - 857 = 2347 - 857 = 1490$$

## EXERCISE LXXXIII.

(1)...

| | | s. | d. | £ | s. | d. |
|---|---|---|---|---|---|---|
| 13 | yds. Cotton Sheeting...... | 1 | 4½ = | 0 | 17 | 10½ |
| 19½ | „ Linen do. ...... | 2 | 5 = | 2 | 7 | 1½ |
| 2 | prs. Blankets ............... | 16 | 6 = | 1 | 13 | 0 |
| 3 | „ do. ............... | 18 | 9 = | 2 | 16 | 3 |
| 3 | „ Counterpanes ......... | 17 | 6 = | 2 | 12 | 6 |
| | | | | £10 | 6 | 9 |

(2)...

| | £ | s. | d. | |
|---|---|---|---|---|
| 2 ro. = ½ of 1 ac. | 2 | 16 | 0 | per acre |
| | | 11 | | |
| | 30 | 16 | 0 | |
| | | 11 | | |
| | 338 | 16 | 0 | |
| 1 ro. = ½ of 2 ro. | 1 | 8 | 0 | |
| 20 per. = ½ of 1 ro. | 0 | 14 | 0 | |
| 5 per. = ¼ of 20 per. | 0 | 7 | 0 | |
| | 0 | 1 | 9 | |
| | £341 | 6 | 9 | |

(3)... $1560 + 1780 + 2350 + 2620 + 3030 + 5740 = 17080$

$$17080 \; : \; 1560 \; :: \; \overset{£}{2135} \; : \; \overset{£ \quad s.}{195 \;\; 0} \quad A$$

$$17080 \; : \; 1780 \; :: \; \overset{£}{2135} \; : \; \overset{£ \quad s.}{222 \; 10} \quad B$$

$$17080 \; : \; 2350 \; :: \; \overset{£}{2135} \; : \; \overset{£ \quad s.}{293 \; 15} \quad C$$

$$17080 \; : \; 2620 \; :: \; \overset{£}{2135} \; : \; \overset{£ \quad s.}{327 \; 10} \quad D$$

$$17080 \; : \; 3030 \; :: \; \overset{£}{2135} \; : \; \overset{£ \quad s.}{378 \; 15} \quad E$$

$$17080 \; : \; 5740 \; :: \; \overset{£}{2135} \; : \; \overset{£ \quad s.}{717 \; 10} \quad F$$

(4)... $\dfrac{\frac{3}{7}}{\frac{5}{8}} = \dfrac{3 \times 8}{5 \times 7} = \dfrac{24}{35}; \quad \dfrac{7\frac{5}{6}}{9} = \dfrac{\frac{47}{6}}{\frac{9}{1}} = \dfrac{47}{9 \times 6} = \dfrac{47}{54};$

$\dfrac{11}{12\frac{4}{7}} = \dfrac{\frac{11}{1}}{\frac{88}{7}} = \dfrac{11 \times 7}{88} = \dfrac{7}{8}; \quad \dfrac{7\frac{5}{9}}{12\frac{7}{8}} = \dfrac{\frac{68}{9}}{\frac{103}{8}} = \dfrac{68 \times 8}{103 \times 9} = \dfrac{544}{927}$

(5)... $\tfrac{7}{12} \times 2\tfrac{5}{8} \times 4\tfrac{1}{2} \times 3\tfrac{4}{7} \times \tfrac{11}{14} \times 5\tfrac{1}{4} \times 1\tfrac{3}{5} \times 3\tfrac{5}{9} \times \tfrac{8}{21} \times \tfrac{1}{5}$

$$= \dfrac{7}{12} \times \dfrac{21}{8} \times \dfrac{9}{2} \times \dfrac{25}{7} \times \dfrac{11}{14} \times \dfrac{21}{4} \times \dfrac{8}{5} \times \dfrac{32}{9} \times \dfrac{8}{21} \times \dfrac{1}{5}$$

$$= 44$$

(6)...

$$\frac{7}{18}\text{ gui.} = \frac{7}{18} \times \frac{\overset{7}{21}}{1} = \frac{49}{6} = \overset{£\ \ \ s.\ \ \ d.}{0\ \ \ 8\ \ \ 2}$$

$$\frac{19}{24}\text{ sov.} = \frac{19}{24} \times \frac{\overset{5}{20}}{1} = \frac{95}{6} = 0\ \ 15\ \ 10$$

$$\frac{7}{8}\text{ cro.} = \frac{7}{8} \times \frac{5}{1} = \frac{35}{8} = 0\ \ 4\ \ 4\tfrac{3}{8}$$

$$\frac{9}{16}\text{ fl.} = \frac{9}{16} \times \frac{2}{1} = \frac{9}{8} = 0\ \ 1\ \ 1\tfrac{1}{8}$$

$$\tfrac{3}{8} = 0\ \ 0\ \ 4\tfrac{1}{2}$$
$$\overline{£1\ \ 9\ \ 10\tfrac{1}{2}}$$

4) 2
12)10·5
40)29·875

$£1.9s\ \ 10\frac{1}{2}d. = \overline{\phantom{xx}}\cdot746875$ of a double sov.

(7)...

$$\frac{19}{32}\text{ ton} = \frac{19}{32} \times \frac{\overset{5}{20}}{1} = \frac{95}{8} = \overset{\text{cwt. qrs. lb.}}{11\ \ 3\ \ 14}$$

$$\tfrac{13}{16} = 0\ \ 3\ \ 7$$
$$\overset{\text{cwt.}}{\overline{12\ \ 2\ \ 21}}\text{ lb.}$$

$$\frac{7}{16}\text{ acre} = \frac{7}{16} \times \frac{4}{1} = \frac{7}{4} = \overset{\text{ro. per.}}{1\ \ 30}$$

$$\tfrac{13}{16} = 0\ \ 26$$
$$\overset{\text{ro.}}{\overline{1\ \ 4}}\text{ per.}$$

(8)...

19 hrs. 22$\frac{1}{2}$ min. = 2325 half minutes
1 day = 2880    ,,
$\frac{2325}{2880} \div \frac{15}{15} = \frac{155}{192}$ of a day

3 days 10 hrs. 30 min. = 4950 minutes
1 week = 10080    ,,
$\frac{4950}{10080} \div \frac{90}{90} = \frac{55}{112}$ of a week

(9)...             50418633969664(7100608
                   49
           141)  141
                 141
        142006)    863396
                   852036
        14201208) 113609664
                  113609664

| £ | | £ | | £ | | £ s. | |
|---|---|---|---|---|---|---|---|
| (10)... 10000 | : | 3500 | :: | 1250 | : | 437 10, | A's share |
| 10000 | : | 4250 | :: | 1250 | : | 531 5, | B's share |
| 10000 | : | 2250 | :: | 1250 | : | 281 5, | C's share |

### EXERCISE LXXXIV.

(1)...    $\frac{2527}{2445} \div \frac{43}{45} = \frac{49}{43}$; $\frac{6715}{5927} \div \frac{79}{79} = \frac{85}{113}$

                2)5  6  7  8  9  10  15  20
                2)5  3  7  4  9   5  15  10
                3)5  3  7  2  9   5  15   5
                5)5  1  7  2  8   5   5   5
                  1  1  7  2  3   1   1   1

        L.C.M. $= 2 \times 2 \times 3 \times 5 \times 7 \times 2 \times 3 = 2520$

(2)...    $(\frac{9}{14}$ of $\frac{17}{27}$ of $8\frac{8}{9}) \times (\frac{7}{17}$ of $1\frac{1}{15}$ of $22\frac{1}{11})$

$= \frac{9}{14} \times \frac{17}{27} \times \frac{80}{9} \times \frac{7}{17} \times \frac{11}{15} \times \frac{243}{11}$

$= 24$

$(1\frac{3}{15}$ of $\frac{25}{36}$ of $14\frac{2}{5}) \div (1\frac{9}{11}$ of $2\frac{4}{9}$ of $9\frac{3}{4})$

$= \frac{13}{15} \times \frac{25}{36} \times \frac{72}{5} \times \frac{11}{10} \times \frac{9}{22} \times \frac{4}{39}$

$= \frac{1}{3}$

(3)...         $\dfrac{5}{18}$ hf. gui. $= \dfrac{5}{\cancel{18}_{6}} \times \dfrac{\cancel{21}^{7}}{2} = \dfrac{35}{12} = 2 \quad 11$

         $\dfrac{9}{16}$ crown $= \dfrac{9}{16} \times \dfrac{5}{1} = \dfrac{45}{16} = 2 \quad 9\tfrac{3}{4}$

                 difference $= \quad 1\tfrac{1}{4}d.$

(4)...      3 fur. 132 yds. $=$   792 yards

                 1 mile $=$ 1760 yards

          $\tfrac{792}{1760} \div \tfrac{88}{88} = \tfrac{9}{20}$ of a mile.

  1 rood 27 per. 15⅛ sq. yds. $=$ 16335 eighths of a sq. yd.

                   1 acre $=$ 38720    ,,     ,,

          $\tfrac{16335}{38720} \div \tfrac{605}{605} = \tfrac{27}{64}$ of an acre

(5)...
```
        16)11                    (8)21
          ·6875             64 {  8) 2·625
                                    ·328125

        50)29                    (8)77
          ·58              512 {  8) 9·625
                                  8) 1·203125
                                     ·150390625
```

(6)...
```
              12)  6
              3)  1·5
            220)192·5
              8)  3·875
```
3 fur. 192 yds. 1 ft. 6 in. $=$  ·484375 of a mile

(7)...
```
                  cwt.
               7·21875
               1·0625£ per cwt.
               3609375
               1443750
               4331250
                721875
```
£7·669921875 $=$ £7 13s. 4¾⁵d.
```
               20
           13·398437500s.
               12
           4·781250000d. = 4¾⁵d.
```

(8)...
$$2\tfrac{1}{2} + 3\tfrac{1}{2} + 4\tfrac{1}{2} + 7\tfrac{1}{2} = 18$$

£64 16s. ÷ 18 = £3 12s.

£3 12s. × $2\tfrac{1}{2}$ = £9
£3 12s. × $3\tfrac{1}{2}$ = £12 12s.
£3 12s. × $4\tfrac{1}{2}$ = £16 4s.
£3 12s. × $7\tfrac{1}{2}$ = £27

(9)... 4 per cent. = $\frac{1}{25}$ of 100

| | £ | s. | d. |
|---|---|---|---|
| | 367 | 10 | 0 | = 350 guineas
$\tfrac{1}{2}$ „ = $\tfrac{1}{8}$ of 4 | 14 | 14 | 0 |
| | 1 | 16 | 9 |
| £16 | 10 | 9 int. for 1 year |
| | | $3\tfrac{3}{4}$ |
| | 49 | 12 | 3 |
$\tfrac{1}{2}$ year = | 8 | 5 | $4\tfrac{1}{2}$
$\tfrac{1}{4}$ „ = | 4 | 2 | $8\tfrac{1}{4}$
| £62 | 0 | $3\tfrac{3}{4}$ int. for $3\tfrac{3}{4}$ years

(10)...
£ s.      £ s.       £ s.
72 5  :  7658 10  ::  3 10  :  Annual income
  4          4          20
───        ─────       ───
289        30634        70s.

Annual income = $\dfrac{\cancel{30634}^{106} \times 70}{\cancel{289}}$ = 7420s. = £371

*EXERCISE LXXXV.*

(1)...
10 t. 17 cwt. = 388864 ounces
3 cwt. 1 qr. 15 lb. 12 oz. = 6076 ounces
388864 ÷ 6076 = 64 times

(2)...
| | | | s. | d. | £ | s. | d. |
|---|---|---|---|---|---|---|---|
| $53\tfrac{1}{2}$ yds. | Brussels Carpeting | ......4 | 3 | = 11 | 7 | $4\tfrac{1}{2}$ |
| $36\tfrac{3}{4}$ | „ | Kidderminster do. | ......2 | 11 | = 5 | 7 | $2\tfrac{1}{4}$ |
| $10\tfrac{1}{4}$ | „ | Drugget | ......2 | 9 | = 1 | 8 | $10\tfrac{1}{2}$ |
| $15\tfrac{3}{4}$ | „ | Matting | ......1 | 9 | = 1 | 7 | $6\tfrac{3}{4}$ |
| | | | | | £19 | 11 | 0 |

$$\begin{array}{ccc} & s. & d. \\ (3)\dots 175 \text{ qrs. Wheat}\dots\dots 48 & 6 & = \end{array}$$

$$\begin{array}{ccc} \pounds & s. & d. \\ 424 & 7 & 6 \end{array}$$

$$350 \text{ guineas } = 367 \quad 10 \quad 0$$

$$42 \left\{ \begin{array}{l} 6)\ \overline{56\ \ 17\ \ 6}\ \text{ value of oats} \\ 7)\ \overline{\ \ 9\ \ \ 9\ \ 7} \end{array}\right.$$

∴   the oats were reckoned at $\overline{\pounds 1 \quad 7 \quad 1}$ per quarter

(4)...

$$1° \ : \ 2° \ 54' \ :: \ \overset{\text{min.}}{4} \ : \ x$$

$$\begin{array}{cc} 60 & 60 \\ \hline \overline{60} & \overline{174} \end{array}$$

$$x = \frac{174 \times \cancel{4}}{\underset{15}{\cancel{60}}} = \frac{174}{15} \text{ min.} = 11 \text{ min. } 36 \text{ sec.}$$

Time at Chester = 12 hrs. − 11 min. 36 sec.
        = 11 hrs. 48 min. 24 sec. A.M.

(5)...

$$\overset{\text{min.}}{4} \ : \ \overset{\text{min. sec.}}{11\ \ 56} \ :: \ 1^{b} \ : \ \text{lon. of Liverpool}$$

$$\begin{array}{cc} 60 & 60 \\ \hline \overline{240} & \overline{716} \end{array}$$

Longitude of Liverpool $= \frac{716}{240} = \frac{179}{60} = 2° \ 59' \ W$

(6)...

$$\tfrac{7}{8} + \tfrac{5}{9} - \tfrac{2}{5} + \tfrac{3}{7} - \tfrac{5}{6} + \tfrac{3}{4}$$

$$= \frac{2205 + 1400 - 1008 + 1080 - 2100 + 1890}{2520}$$

$$= \tfrac{6575}{2520} - \tfrac{3108}{2520} = \tfrac{3467}{2520} = 1\tfrac{947}{2520}$$

(7)...

$$51\tfrac{1}{3} \div \left( \tfrac{7}{11} \text{ of } \tfrac{9}{14} \text{ of } 14\tfrac{2}{3} \right)$$

$$= \frac{\overset{7}{\cancel{154}}}{\cancel{3}} \times \frac{11}{7} \times \frac{\overset{7}{\cancel{14}}}{9} \times \frac{\cancel{3}}{\underset{2}{\cancel{44}}} = \frac{77}{9} = 8\tfrac{5}{9}$$

(8)...      $267 \cdot 832 ) 79 \cdot 4260000 ( \cdot 2965 \ldots\ldots$

$$
\begin{array}{r}
535664 \\
\overline{2585960} \\
2410488 \\
\overline{1754720} \\
1606992 \\
\overline{1477280} \\
1339160 \\
\overline{138120}
\end{array}
$$

(9)...

$$
\begin{array}{ll}
4)3 & 40)35 \\
\overline{12)9 \cdot 75} & \overline{4)\ 3 \cdot 875} \\
\overline{20)7 \cdot 8125} &
\end{array}
$$

3 ro. 35 per. $= \cdot 96875$ of an acre

$7s.\ 9\frac{3}{4}d. = \cdot 390625$ of a sov.

(10)...

$$
\sqrt{\tfrac{49}{121}} = \tfrac{7}{11}
$$

$$
\sqrt{4\tfrac{13}{49}} = \sqrt{\tfrac{225}{49}} = \tfrac{15}{7} = 2\tfrac{1}{7}
$$

$$
\sqrt{54\tfrac{25}{64}} = \sqrt{\tfrac{3481}{64}} = \tfrac{59}{8} = 7\tfrac{3}{8}
$$

$$
\sqrt{179\tfrac{14}{25}} = \sqrt{\tfrac{4489}{25}} = \tfrac{67}{5} = 13\tfrac{2}{5}
$$

## EXERCISE LXXXVI.

(1)...

$$
\begin{array}{rrr}
\pounds & s. & d. \\
615 & 17 & 11 \\
\end{array}
$$

$$
\begin{array}{r}
20 \\
\overline{7814)12317}(1s.\ 6\tfrac{7103}{7814}d. \\
7814 \\
\overline{4503} \\
12 \\
\overline{7814)54047}(6d. \\
46884 \\
\overline{7163} \\
7814
\end{array}
$$

(2)...25 qrs. 2 bu. 2 pks. at 28s. per quarter $= \pounds 35\ 8s.\ 9d.$

$\pounds 35\ 8s.\ 9d. \div 4\frac{1}{2}$ gui. $= 7\frac{1}{2}$ tons

(3)...$\frac{17}{50}$ sq. mile $=\frac{17}{50}$ of 640 ac. $=217\frac{3}{5}$ ac. $=217$ ac. 2ro. 16 per.

(4)...        $2\cdot37$   :   $\cdot065$   ::   $40\cdot29$
                       17                  17
                      ‾‾‾‾‾
                      455
                       65
                      ‾‾‾‾‾‾
                      1·105

<pre>
        men da.      men da.      ac.
(5)...   9×8    :    6×7    ::    27   :   x
</pre>

$$x = \frac{\overset{3}{\cancel{6}} \times 7 \times \overset{3}{\cancel{27}}}{\underset{4}{\cancel{9} \times \cancel{8}}} = \frac{63}{4}\text{ ac.} = 15\frac{3}{4}\text{ acres}$$

<pre>
         £   yrs.        £   yrs.        £   s.
(6)...  160×2¼    :     250×3½    ::    13  10   :   x
          4                4                20
         ‾‾               ‾‾‾              ‾‾‾‾
          9                14              270
</pre>

$$x = \frac{\overset{25}{\cancel{250}} \times \overset{7}{\cancel{14}} \times \overset{\overset{15}{\cancel{30}}}{\cancel{270}}}{\underset{\underset{4}{\underset{\cancel{8}}{\cancel{16}}}}{\cancel{100}} \times \cancel{9}} = 2625s. = £32\ 16s.\ 3d.$$

<pre>
(7)...  100
         16
        ‾‾‾‾                       £   s.   d.
        116   :   100   ::         2   3    6   :   prime cost
                                   20
                                  ‾‾‾‾
                                   43
                                   12
                                  ‾‾‾‾
                                   522
</pre>

$$\text{prime cost} = \frac{\overset{25}{\cancel{100}} \times \overset{18}{\cancel{522}}}{\underset{4}{\cancel{116}}} = 450d. = £1\ 17s.\ 6d.\text{ per cwt.}$$

(8)... profit per cwt. = £3 10s.—£3 2s. 6d. = 7s. 6d.

$$\begin{array}{cc} \pounds \quad s. \quad d. & s. \quad d. \\ 3 \quad 2 \quad 6 \;:\; 7 \quad 6 \;::\; 100 \;:\; 12 \text{ per cent.} \end{array}$$

(9)... Loss = $100-87\frac{1}{2} = 12\frac{1}{2} = \frac{1}{8}$ of value

$$\begin{array}{r} \pounds \quad s. \quad d. \\ 8)12500 \quad 0 \quad 0 \\ \overline{16)1562 \quad 10 \quad 0} \text{ loss on ship} \\ \overline{97 \quad 13 \quad 1\frac{1}{2}} \\ 3 \\ \overline{\pounds292 \quad 19 \quad 4\frac{1}{2}} \end{array}$$

(10)...

$$\begin{array}{r} 1769{\cdot}0436(42{\cdot}06 \\ 16 \\ \overline{82) \;169} \\ 164 \\ \overline{8406) \;\;50436} \\ 50436 \end{array}$$

## EXERCISE LXXXVII.

(1)...  1.

$$\begin{array}{r} \pounds \quad s. \quad d. \\ 64 \quad 0 \quad 0 \text{ per acre} \\ 7\times8+1 = 57 \\ \overline{448 \quad 0 \quad 0} \\ 8 \\ \overline{3584 \quad 0 \quad 0} \end{array}$$

| | £ | s. | d. |
|---|---|---|---|
| 2 roods = $\frac{1}{2}$ of 1 ac. | 64 | 0 | 0 |
| 1 rood = $\frac{1}{2}$ of 2 ro. | 32 | 0 | 0 |
| 20 per. = $\frac{1}{2}$ of 1 ro. | 16 | 0 | 0 |
| 5 per. = $\frac{1}{4}$ of 20 per. | 8 | 0 | 0 |
| 2½ per. = $\frac{1}{2}$ of 5 per. | 2 | 0 | 0 |
| | 1 | 0 | 0 |
| | £3707 | 0 | 0 |

<pre>
                          £   s.  d.
2.  2 qrs. = ½ of 1 cwt. | 3   3   0 per cwt.
                                9 × 12 + 5 = 113
                         ┌─────────────
                         28   7   0
                                 12
                         ┌─────────────
                         340   4   0
                          15  15   0
   14 lb. = ¼ of 2 qrs.    1  11   6
    4 lb. = ¹⁄₁₄ of 2 qrs.     7  10½
                               2   3
                         ────────────
                     £358   0   7½
</pre>

<pre>
                      £   s.  d.
3.                    2   2   8 per quarter
                            4 × 7 + 1 = 29
                     ┌──────────
                      8  10   8
                              7
                     ┌──────────
                     59  14   8
   4 bu. = ½ of 1 qr.  2   2   8
   1 bu. = ¼ of 4 bu.  1   1   4
   2 pks. = ½ of 1 bu.     5   4
   1 gal. = ¼ of 2 pks.    2   8
   2 qts. = ⅓ of 1 gal.        8
   1 qt. = ½ of 2 qts.         4
                               2
                     ────────────
                   £63   7  10
</pre>

(2)...        $\left(\frac{5}{9} \text{ of } 6\frac{3}{4}\right) - \left(\frac{4}{7} \text{ of } 3\frac{1}{9}\right)$

$$= \left(\frac{5}{\overset{}{\underset{}{9}}} \times \frac{\overset{3}{\cancel{27}}}{4}\right) - \left(\frac{4}{7} \times \frac{\overset{4}{\cancel{28}}}{9}\right)$$

$$= \frac{15}{4} - \frac{16}{9} = \frac{135 - 64}{36} = \frac{71}{36} = 1\frac{35}{36}$$

(3)...
$$\frac{7\frac{2}{3}-2\frac{5}{6}}{8\frac{1}{3}+7\frac{2}{5}} = \frac{7\frac{18}{30}-2\frac{25}{30}}{8\frac{5}{15}+7\frac{6}{15}} = \frac{4\frac{23}{30}}{15\frac{11}{15}} = \frac{\frac{143}{30}}{\frac{236}{15}} = \frac{143}{472};$$

$$\frac{4\frac{1}{2}\times 2\frac{7}{7}}{8\frac{1}{4}+1\frac{2}{5}} = \cfrac{\dfrac{\overset{3}{\cancel{21}}}{5}\times\dfrac{\overset{4}{\cancel{20}}}{7}}{\dfrac{\cancel{33}}{4}\times\dfrac{9}{\cancel{11}}} = \cfrac{12}{\dfrac{27}{4}} = \frac{\overset{4}{\cancel{12}}\times 4}{\underset{9}{\cancel{27}}} = \frac{16}{9} = 1\frac{7}{9}$$

(4)...
$$\frac{17}{32}\text{ sov.} = \frac{17}{\underset{8}{\cancel{32}}}\times\frac{\overset{5}{\cancel{20}}}{1} = \frac{85}{8} = \overset{s.}{10}\quad\overset{d.}{7\tfrac{1}{2}}$$

$$\frac{11}{28}\text{ gui.} = \frac{11}{\underset{4}{\cancel{28}}}\times\frac{\overset{3}{\cancel{21}}}{1} = \frac{33}{4} = \dfrac{8\quad 3}{2s.\ 4\tfrac{1}{2}d.}$$

(5)...
$$\frac{13}{21}\text{ mo.} = \frac{13}{\underset{3}{\cancel{21}}}\times\frac{\overset{4}{\cancel{28}}}{1} = \frac{52}{3}\text{ da.} = \overset{\text{da. hrs. min.}}{17\quad 8\quad 0}$$

$$\frac{17}{24}\text{ week} = \frac{17}{24}\times\frac{7}{1} = \frac{119}{24}\text{ da.} = 4\quad 23\quad 0$$

$$\frac{11}{88}\text{ da.} = \frac{11}{\underset{3}{\cancel{18}}}\times\frac{\overset{4}{\cancel{24}}}{1} = \frac{44}{8}\text{ ho.} = \quad 14\quad 40$$

$$\frac{9}{20}\text{ hour} = \frac{9}{\cancel{20}}\times\frac{\overset{3}{\cancel{60}}}{1} = 27\text{ min.} = \dfrac{\qquad\qquad 27}{\text{days}\ \ 22\quad 22\quad 7\ \text{min.}}$$

(6)...

$$A \text{ can do } \tfrac{1}{12} \text{ in 1 day}$$
$$B \text{ can do } \tfrac{1}{15} \text{ in 1 day}$$

$A + B$ can do $\tfrac{1}{12} + \tfrac{1}{15} = \tfrac{5}{60} + \tfrac{4}{60} = \tfrac{9}{60} = \tfrac{3}{20}$ in 1 day

∴ together they would complete the work in $\tfrac{20}{3} = 6\tfrac{2}{3}$ days

(7)...

$$\tfrac{13}{30} + \tfrac{1}{5} = \tfrac{13}{30} + \tfrac{6}{30} = \tfrac{19}{30}$$

$$1 - \tfrac{19}{30} = \tfrac{11}{30} \text{ which is } = \pounds 2750$$

$$\overset{\pounds}{\phantom{x}} \qquad \overset{\pounds}{\phantom{x}}$$
$$\tfrac{11}{30} \; : \; 1 \; :: \; 2750 \; : \; 7500$$

(8)...

| £ | s. | d. | |
|---|---|---|---|
| 495 | 2 | 2 | amount |
| 419 | 11 | 8 | principal |
| £75 | 10 | 6 | int. for 4½ years |

£75 10s. 6d. ÷ 4½ = £16 15s. 8d., int. for 1 year

£ s. d.       £        £ s. d.
419 11 8  :  100  ::  16 15 8  :  4 per cent.

(9)...    Amount of £100 in 5½ years at 4½ per cent.
= £100 + (£4 10s. × 5½) = £124 15s.

£ s.        £ s. d.        £
124 15  :  421 0 7½  ::  100  :  £337 10s.

(10)...

$$(753)^2 = \begin{array}{r} 1463818 \\ 567009 \\ \hline 896809(947 \\ 81 \\ \hline 184)\ \overline{868} \\ 736 \\ \hline 1887)\overline{13209} \\ 13209 \\ \hline \end{array}$$

*EXERCISE LXXXVIII.*

(1)... 493)1073(2
         986
        $\overline{\quad}$87)493(5
            435
           $\overline{\quad}$58)87(1
              58
             $\overline{\quad}$29)58(2
                58
                $\overline{\quad}$

29)1537(53
   145
  $\overline{\quad}$87
   87
   $\overline{\quad}$

G.C.M. required = 29

G.C.M. of 493 and 1073 = 29

| 2)5 | 7 | 9 | 12 | 15 | 18 | 21 | 27 |
|---|---|---|---|---|---|---|---|
| 3)5 | 7 | 9 | 6 | 15 | 9 | 21 | 27 |
| 3)5 | 7 | 3 | 2 | 5 | 3 | 7 | 9 |
| 5)5 | 7 | 1 | 2 | 5 | 1 | 7 | 3 |
| 7)1 | 7 | 1 | 2 | 1 | 1 | 7 | 3 |
| 1 | 1 | 1 | 2 | 1 | 1 | 1 | 3 |

L.C.M. $= 2 \times 3 \times 3 \times 5 \times 7 \times 2 \times 3 = 3780$

(2)...

$1\frac{5}{6} \times 2\frac{2}{3} \times 5\frac{1}{4} \times \frac{6}{11} \times 3\frac{3}{5} \times 2\frac{2}{7}$

$= \frac{11}{6} \times \frac{\overset{4}{20}}{9} \times \frac{\overset{3}{21}}{4} \times \frac{6}{11} \times \frac{\overset{2}{18}}{5} \times \frac{16}{7} = 96$

$\frac{6\frac{3}{4} \times 3\frac{5}{9}}{7\frac{1}{2} + \frac{5}{8}} = \frac{\frac{\overset{3}{27}}{4} \times \frac{\overset{8}{32}}{9}}{\frac{15}{2} \times \frac{8}{5}} = \frac{24}{12} = 2$

o

(3)...
$$
\begin{array}{r}
7\cdot0046 \\
\cdot215 \\
\hline
350230 \\
70046 \\
140092 \\
\hline
1\cdot5059890
\end{array}
$$

$$
\begin{array}{r}
\cdot0565)8\cdot2500000(146\cdot017\ldots\ldots \\
565 \\
\hline
2600 \\
2260 \\
\hline
3400 \\
3390 \\
\hline
1000 \\
565 \\
\hline
4350 \\
3955 \\
\hline
395
\end{array}
$$

(4)...
$$\frac{23}{36}\ \text{gui.} = \frac{23}{\cancel{36}_{12}}\times\frac{\cancel{21}^{7}}{1} = \frac{161}{12} = 13 \overset{s.}{\phantom{x}} \overset{d.}{5}$$

$$\tfrac{19}{24}\ \text{cr.} = \tfrac{19}{24}\times\tfrac{5}{1} = \tfrac{95}{24} = \ \ 3\ \ 11\tfrac{1}{2}$$

sov.
$$
\begin{array}{r}
\cdot48125 = 9s.\ 7\tfrac{1}{2}d. \\
20 \\
\hline
9\cdot62500s. \\
12 \\
\hline
7\cdot50000d. \\
4 \\
\hline
2\cdot00000\ \text{far.}
\end{array}
$$

fl.
$$
\begin{array}{r}
\cdot65625 = 1s.\ 3\tfrac{3}{4}d. \\
2 \\
\hline
1\cdot31250s. \\
12 \\
\hline
3\cdot75000d. \\
4 \\
\hline
3\cdot00000\ \text{far.}
\end{array}
$$

$$
\begin{array}{lr}
 & s.\quad d. \\
\tfrac{23}{36}\ \text{of a guinea} = & 13\quad 5 \\
\cdot48125\ \text{of a sov.} \ = & 9\quad 7\tfrac{1}{2} \\
\tfrac{19}{24}\ \text{of a crown} = & 3\quad 11\tfrac{1}{4} \\
\cdot65625\ \text{of a florin} \ = & 1\quad 3\tfrac{3}{4} \\
\hline
\pounds 1 & 8\quad 3\tfrac{3}{4}
\end{array}
$$

(5)...
1.
$$
\begin{array}{lll}
s.\ d. & & \\
5\ 0 = \tfrac{1}{4}\ \text{of } \pounds1 & & \\
1\ 3 = \tfrac{1}{4}\ \text{of } 5s. & & \\
3\tfrac{3}{4} = \tfrac{1}{4}\ \text{of } 1s.\ 3d. & & \\
1 = \tfrac{1}{15}\ \text{of } 1s.\ 3d. & &
\end{array}
$$

$$
\begin{array}{rrr}
\pounds & s. & d. \\
1527 & 0 & 0\ \text{=value at }\pounds1\ \text{ea} \\
381 & 15 & 0 \\
95 & 8 & 9 \\
23 & 17 & 2\tfrac{1}{4} \\
6 & 7 & 3 \\
\hline
\pounds507 & 8 & 2\tfrac{1}{4}
\end{array}
$$

2.

| *s. d.* | | | | *£* | *s.* | *d.* | |
|---|---|---|---|---|---|---|---|
| 10 0 | = | ½ | of £1 | 2439 | 0 | 0 | =value at £1 each |
| 5 0 | = | ¼ | of 10*s.* | 1219 | 10 | 0 | |
| 2 6 | = | ½ | of 5*s.* | 609 | 15 | 0 | |
| 2½ | = | $\frac{1}{13}$ | of 2*s.* 6*d.* | 304 | 17 | 6 | |
| | | | | 25 | 8 | 1½ | |
| | | | | £2159 | 10 | 7½ | |

3.

| *s. d.* | | | | *£* | *s.* | *d.* | |
|---|---|---|---|---|---|---|---|
| 10 0 | = | ½ | of £1 | 967 | 0 | 0 | = value at £1 each |
| | | | | | | 5 | |
| | | | | 4835 | 0 | 0 | |
| 2 6 | = | ¼ | of 10*s.* | 483 | 10 | 0 | |
| 1 3 | = | ½ | of 2*s.* 6*d.* | 120 | 17 | 6 | |
| 5 | = | ⅓ | of 1*s.* 3*d.* | 60 | 8 | 9 | |
| ½ | = | $\frac{1}{10}$ | of 5*d.* | 20 | 2 | 11 | |
| | | | | 2 | 0 | 3½ | |
| | | | | £5521 | 19 | 5¼ | |

(6)...

| hor. da. | | hor. da. | | bu. | | bu. |
|---|---|---|---|---|---|---|
| $9 \times 20$ | : | $17 \times x$ | :: | 45 | : | 68 |

$$x = \frac{\overset{4}{9} \times \overset{4}{\cancel{20}} \times \cancel{68}}{\cancel{17} \times \underset{5}{\cancel{45}}} = 16 \text{ days}$$

(7)...

| m. da. hrs. | | m. da. hrs. | | *£* | *s.* | *d.* | | |
|---|---|---|---|---|---|---|---|---|
| $9 \times 13 \times 9$ | : | $13 \times 17 \times 11$ | :: | 26 | 6 | 6 | : | *x* |
| | | | | 20 | | | | |
| | | | | 526 | | | | |
| | | | | 12 | | | | |
| | | | | 6318 | | | | |

$$x = \frac{\cancel{13} \times 17 \times 11 \times \overset{\overset{78}{702}}{\cancel{6318}}}{\cancel{9} \times \cancel{13} \times \cancel{9}} = 14586d. = £60 \ 15s. \ 6d.$$

$$\begin{array}{lll} & \pounds & s. & d. \end{array}$$

(8)...   4 per cent. = $\frac{1}{25}$ of 100|262  10   0 = 250 guineas

$\frac{1}{2}$    „    = $\frac{1}{8}$ of 4  | ‾10 ‾10 ‾0

            1   6   3

$\overline{\pounds 11\ \ 16\ \ \ 3}$ int. for 1 year

                    3$\frac{1}{2}$

            $\overline{35\ \ \ 8\ \ \ 9}$

             5  18  1$\frac{1}{2}$

$\overline{\pounds 41\ \ \ 6\ \ 10\frac{1}{2}}$ int. for 3$\frac{1}{2}$ years


$$\begin{array}{lll} & \pounds & s. & d. \end{array}$$

(9)...        1$\frac{1}{4}$ per cent. = $\frac{1}{80}$ of 100|475   0   0

                        $\overline{\pounds 5\ \ 18\ \ \ 9}$


(10)...   $\cdot 11737476(\cdot 3426$            $\cdot 00025281(\cdot 0159$
              9                                 1
         64) $\overline{273}$                  25)$\overline{152}$
             256                                125
         682) $\overline{1774}$               309) $\overline{2781}$
              1364                                 2781
         6846) $\overline{41076}$
               41076


## EXERCISE LXXXIX.

|  |  |  | s. | d. |  | £ | s. | d. |
|---|---|---|---|---|---|---|---|---|
| (1)... | 13$\frac{3}{4}$ yds. | Silk Velvet...... | 7 | 6 | = | 5 | 3 | 1$\frac{1}{2}$ |
|  | 7$\frac{1}{2}$ „ | Crape ............ | 2 | 9 | = | 1 | 0 | 7$\frac{1}{2}$ |
|  | 3$\frac{5}{8}$ „ | Cloth ............ | 10 | 8 | = | 1 | 18 | 8 |
|  | 26$\frac{1}{2}$ „ | Irish Linen...... | 1 | 10 | = | 2 | 8 | 7 |
|  | 18 „ | Flannel ......... | 1 | 4 | = | 1 | 4 | 0 |

                                              $\overline{11\ \ 15\ \ \ 0}$

Discount, 2$\frac{1}{2}$ per cent. = $\frac{1}{40}$ of 100 =     5  10$\frac{1}{2}$

                                      $\overline{\pounds 11\ \ \ 9\ \ \ 1\frac{1}{2}}$

|  | lb. | oz. |  | lb. | oz. |  | £ | s. | d. |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|
| (2)... | 7 | 11 | : | 77 | 7 | :: | 1 | 8 | $2\frac{1}{4}$ | : | $x$ |
|  | 16 |  |  | 16 |  |  | 20 |  |  |  |  |
|  | $\overline{123}$ |  |  | $\overline{1239}$ |  |  | $\overline{28}$ |  |  |  |  |
|  |  |  |  |  |  |  | 12 |  |  |  |  |
|  |  |  |  |  |  |  | $\overline{338}$ |  |  |  |  |
|  |  |  |  |  |  |  | 4 |  |  |  |  |
|  |  |  |  |  |  |  | $\overline{1353}$ |  |  |  |  |

$$x = \frac{1239 \times \overset{11}{\cancel{1353}}}{\cancel{123}} = 13629 \text{ far.} = \text{£}14 \ 3s. \ 11\tfrac{1}{4}d.$$

(3)...
$$(1\tfrac{4}{7})^2 \times (3\tfrac{1}{2})^3 = \frac{\overset{3}{\cancel{\overset{6}{\cancel{12}}}}}{7} \times \frac{\overset{6}{\cancel{12}}}{7} \times \frac{7}{\cancel{2}} \times \frac{7}{\cancel{2}} \times \frac{7}{\cancel{2}} = 126$$

(4)...
$$\frac{25}{42} \text{ gui.} = \frac{25}{\cancel{42}} \times \frac{\overset{s.}{\cancel{21}}}{1} = \frac{25}{2} = \overset{s.}{12} \ \overset{d.}{6}$$

$$\frac{37}{64} \text{ sov.} = \frac{37}{\cancel{64}} \times \frac{\overset{5}{\cancel{20}}}{1} = \frac{185}{16} = 11 \ 6\tfrac{3}{4}$$

$$16 \quad \text{difference} = \overline{\phantom{00}11\tfrac{1}{4}}$$

(5)...
$$\overset{\text{week}}{\cdot 3125} = 2 \text{ days } 4 \text{ hrs. } 30 \text{ min.}$$
$$\frac{7}{\overline{2 \cdot 1875}} \text{ da.}$$
$$\frac{24}{\overline{4 \cdot 5000}} \text{ hrs.}$$
$$\frac{60}{\overline{30 \cdot 0000}} \text{ min.}$$

$$\frac{37}{96} \text{ da.} = \frac{37}{\cancel{96}} \times \frac{\overset{\text{hrs.}}{\cancel{24}}}{1} = \frac{37}{4} = 9 \text{ hrs. } 15 \text{ min.}$$

|  | da. | hrs. | min. |
|---|---|---|---|
|  | 2 | 4 | 30 |
|  |  | 9 | 15 |
| day | $\overline{1}$ | $\overline{19}$ | $\overline{15}$ min. |

(6)...

$$\qquad\qquad\qquad\qquad\qquad \begin{array}{ccc} \pounds & s. & d. \end{array}$$

$$\tfrac{6}{11}\text{ of }\pounds 4\ 4s.\ 4d. = \begin{array}{ccc} 1 & 18 & 4 \end{array}$$

$$\tfrac{3}{8}\text{ of }\pounds 4\ 4s.\ 4d. = \begin{array}{ccc} 1 & 11 & 7\tfrac{1}{2} \end{array}$$

$$\qquad\qquad\qquad\qquad \overline{\begin{array}{ccc} \pounds 3 & 9 & 11\tfrac{1}{2} \end{array}}.$$

$$\qquad\qquad\qquad\qquad \begin{array}{ccc} \pounds & s. & d. \end{array}$$

$$\qquad\qquad\qquad\qquad \begin{array}{ccc} 4 & 4 & 4 \end{array}$$

sum spent     $= \begin{array}{ccc} 3 & 9 & 11\tfrac{1}{2} \end{array}$

sum remaining $= \overline{\begin{array}{cc} 14s. & 4\tfrac{1}{2}d. \end{array}}$

(7)...

$$\qquad\qquad \begin{array}{ccc} \text{hrs.} & \text{hrs.} & \text{mi.} \end{array}$$

$$\qquad\qquad 8\tfrac{1}{2} \quad : \quad 7\tfrac{1}{12} \ :: \ 7\tfrac{3}{4} \quad : \quad x$$

$$x = \frac{\overset{}{2}}{\underset{}{17}} \times \frac{\overset{5}{85}}{\underset{6}{12}} \times \frac{31}{4} = \frac{155}{24}\text{ mi.} = 6\tfrac{11}{24}\text{ miles per hour}$$

(8)...

$$\qquad\qquad \text{If A's share} = 1$$

$$\qquad\qquad \text{B's share} = \tfrac{4}{5}$$

$$\qquad\qquad \text{and C's share} = \tfrac{5}{7}\text{ of }\tfrac{4}{5} = \tfrac{4}{7}$$

$$1 + \frac{4}{5} + \frac{4}{7} = \frac{35 + 28 + 20}{35} = \frac{83}{35}$$

$$\tfrac{83}{35} \quad : \quad 1 \quad :: \quad \pounds 145\ 5s. = \pounds 145\tfrac{1}{4} \quad : \quad x$$

$$x = \frac{35}{\underset{}{83}} \times \frac{\overset{7}{581}}{4} = \pounds\frac{245}{4} = \pounds 61\ 5s. \quad \text{A's share}$$

$$\tfrac{4}{5}\text{ of }\pounds 61\ 5s. = \pounds 49\ 0s. \quad \text{B's share}$$

$$\tfrac{5}{7}\text{ of }\pounds 49\ 0s. = \pounds 35\ 0s. \quad \text{C's share}$$

$$\qquad\qquad\qquad\qquad \overline{\pounds 145\ 5s.}$$

(9)...

$$\qquad\qquad\qquad\qquad\qquad \begin{array}{cc} \pounds & s. \end{array}$$

$$4\tfrac{1}{2} \quad : \quad 100 \quad :: \quad \begin{array}{cc} 169 & 13 \end{array} \quad : \quad \text{cost of farm}$$

$$\tfrac{2}{9} \qquad\qquad \tfrac{2}{200} \qquad\qquad \tfrac{20}{3393}$$

$$\text{cost of farm} = \frac{200 \times \overset{377}{3393}}{\underset{}{9}} = 75400s. = \pounds 3770$$

(10)...

$$2989683684(54678$$
$$\phantom{2989683}25$$
$$104)\ \overline{489}$$
$$\phantom{104)\ }416$$
$$1086)\ \overline{7368}$$
$$\phantom{1086)\ }6516$$
$$10927)\ \overline{85236}$$
$$\phantom{10927)\ }76489$$
$$109348)\ \overline{874784}$$
$$\phantom{109348)\ }874784$$

$$38950081(6241$$
$$\phantom{389}36$$
$$122)\ \overline{295} \qquad\qquad 6241(79$$
$$\phantom{122)\ }244 \qquad\qquad\phantom{6241(}49$$
$$1244)\ \overline{5100} \qquad 149)\overline{1341}$$
$$\phantom{1244)\ }4976 \qquad\phantom{149)}1341$$
$$12481)\ \overline{12481}$$
$$\phantom{12481)\ }12481$$

*EXERCISE XC.*

(1)...

| cwt. | qrs. | lb. |   | cwt. | qr. | lb. |   | £ | s. | d. |   |   |
|------|------|-----|---|------|-----|-----|---|---|----|----|---|---|
| 2 | 2 | 14 | : | 3 | 1 | 21 | :: | 18 | 1 | $4\frac{1}{2}$ | : | $x$ |
| 4 |   |   |   | 4 |   |   |   | 20 |   |   |   |   |
| $\overline{10}$ |   |   |   | $\overline{13}$ |   |   |   | $\overline{361}$ |   |   |   |   |
| 28 |   |   |   | 28 |   |   |   | 12 |   |   |   |   |
| $\overline{294}$ |   |   |   | $\overline{385}$ |   |   |   | $\overline{4336}$ |   |   |   |   |
|   |   |   |   |   |   |   |   | 4 |   |   |   |   |
|   |   |   |   |   |   |   |   | $\overline{17346}$ |   |   |   |   |

$$x = \frac{\overset{55}{\cancel{385}} \times \overset{413}{\cancel{17346}}}{\underset{\cancel{42}}{\cancel{294}}} = 22715 \text{ far.} = £23\ 13s.\ 2\tfrac{1}{4}d.$$

$$£ \quad s.$$

(2)...                                       271   5
                                               7

$17\frac{5}{7} \times 7 =$ 124)$\overline{1898\ 15}$($£15$ 6s. 3d.
                        124
                        ───
                        658
                        620
                        ───
                         38
                         20
                  124)$\overline{775}$(6s.
                      744
                      ───
                       31
                       12
                  124)$\overline{372}$(3d.
                      372
                      ───

(3)...

|  | £ | s. | d. |
|---|---|---|---|
| $£1\frac{13}{24} =$ | 1 | 10 | 10 |
| $13\frac{5}{6}s. =$ | 0 | 13 | 10 |
| $7\frac{3}{4}d. =$ | 0 | 0 | $7\frac{3}{4}$ |
| | $£2$ | 5 | $3\frac{3}{4}$ |

= 

4)3
12)$\overline{3\cdot75}$
20)$\overline{5\cdot3125}$
5)$\overline{2\cdot265625}$
·453125 of £5

(4)...        23·5            (5)...  $(\cdot17)^2 =$ ·0289
             17·6                    $(\cdot5)^3 =$ ·125
            ─────                          ─────
             1410                           1445
             1645                            578
              235                            289
            ───────                       ────────
            413·60                        ·0036125
              9·25
            ───────
            206800
             82720
            372240
          ──────────
          3825·8000

(6)...   178·35)45657·60(256      67·8)71·90190(1·0605
              35670                    678
             ───────                  ─────
              99876                   4101
              89175                   4068
             ────────                ──────
             107010                   3390
             107010                   3390
             ────────                ──────

(7)...

$$\begin{array}{ccc} \pounds & s. & d. \\ 724 & 3 & 4 \text{ amount} \\ 617 & 3 & 9 \text{ principal} \\ \hline \pounds106 & 19 & 7 \text{ interest} \end{array}$$

4 per cent. = $\frac{1}{25}$ of 100 | $\begin{array}{ccc} \pounds. & s. & d. \\ 617 & 3 & 9 \end{array}$

$\frac{1}{4}$ per cent. = $\frac{1}{12}$ of 4 | $\begin{array}{ccc} 24 & 13 & 9 \\ 2 & 1 & 1\frac{3}{4} \\ \hline \pounds26 & 14 & 10\frac{3}{4} \text{ interest for 1 year} \end{array}$

$$\begin{array}{ccccccccccc} \pounds & s. & d. & & \pounds & s. & d. & & \text{yr.} & & \text{yrs.} \\ 26 & 14 & 10\frac{3}{4} & : & 106 & 19 & 7 & :: & 1 & : & 4 \end{array}$$

(8)...    112 lb. at $3\frac{1}{2}d.$ per oz. = $\begin{array}{ccc} \pounds & s. & d. \\ 26 & 2 & 8 \end{array}$

$$\begin{array}{cccc} \text{cost} = & 18 & 13 & 4 \\ \text{profit} = & \pounds7 & 9 & 4 \end{array}$$

$$\begin{array}{ccccccccccc} \pounds & s. & d. & & \pounds & s. & d. & & & & \\ 18 & 13 & 4 & : & 7 & 9 & 4 & :: & 100 & : & 40 \text{ per cent.} \end{array}$$

(9)...                20226200\overset{.}{3}(587

$$5^3 = 125$$

$5^2 \times 300 = 7500 \overline{)77262}$

$$\begin{array}{rl} 60000 & = 7500 \times 8 \\ 9600 & = 5 \times 30 \times 8^2 \\ 512 & = 8^3 \\ \hline 70112 & \text{subtrahend} \end{array}$$

$58^2 \times 300 = 1009200 \overline{)7150003}$

$$\begin{array}{rl} 7064400 & = 1009200 \times 7 \\ 85260 & = 58 \times 30 \times 7^2 \\ 343 & = 7^3 \\ \hline 7150003 \end{array}$$

4

(10)...        $(\frac{1}{3}+£25)+(\frac{1}{4}+£122 \ 10s.)+(\frac{1}{5}+£145)$

$\frac{1}{3}+\frac{1}{4}+\frac{1}{5}+£292 \ 10s.$

$\dfrac{1}{3}+\dfrac{1}{4}+\dfrac{1}{5} = \dfrac{20+15+12}{60} = \dfrac{47}{60}$

$1-\frac{47}{60} = \frac{13}{60}$, which is $= £292 \ 10s.$

$$\begin{array}{ccccc} & & & £ \quad s. & £ \\ \frac{13}{60} & : & 1 & :: \quad 292 \ \ 10 = 292\frac{1}{2} & : \quad \text{sum divided} \end{array}$$

$$\text{sum divided} = \frac{\cancel{60}}{\cancel{13}} \times \frac{\cancel{585}}{\cancel{2}} = £1350$$

(with $30$ and $45$ noted above)

$(\frac{1}{3}$ of $£1350)+£25 \qquad = £475$, A's share

$(\frac{1}{4}$ of $£1350)+£122 \ 10s. = £460$, B's share

$(\frac{1}{5}$ of $£1350)+£145 \qquad = £415$, C's share

## EXERCISE XCI.

(1)...   See "*Answers.*"

(2)...        $25 \begin{cases} 5)17 \\ \overline{5)3\cdot4} \end{cases}$        $32 \begin{cases} 4)23 \\ \overline{8)5\cdot75} \end{cases}$

                    $\overline{\cdot 68}$                    $\overline{\cdot 71875}$

   $12)7$                                        $18 \begin{cases} 2)11 \\ 9)5\cdot5 \end{cases}$

      $\overline{\cdot 583\dot3}$ &c. $= \cdot 58\dot3$                    $\overline{\cdot 611}$ &c. $= \cdot 6\dot1$

(3)...                              £   s.   d.
                                    5    6    8 per ton

                                         $4 \times 7 + 1 = 29$

$$\begin{array}{rrr} 21 & 6 & 8 \\ & & 7 \\ \hline 149 & 6 & 8 \end{array}$$

10 cwt. $= \frac{1}{2}$ of 1 ton            5    6    8

$2\frac{1}{2}$ cwt. $= \frac{1}{4}$ of 10 cwt.        2   13    4

$1\frac{1}{4}$ cwt. $= \frac{1}{2}$ of $2\frac{1}{2}$ cwt.            13    4

14 lb. $= \frac{1}{10}$ of $1\frac{1}{4}$ cwt.            6    8

7 lb. $= \frac{1}{2}$ of 14 lb.                    8

                                                        4

                              £158    7    8

(4)... $9\frac{33}{80}$ tons $= 188\frac{1}{4}$ cwt.

$$\begin{array}{ccccccc} \text{cwt.} & & \text{cwt.} & & \pounds & & \\ 13\frac{9}{14} & : & 188\frac{1}{4} & :: & 14\frac{13}{40} & : & x \end{array}$$

$$x = \frac{\overset{7}{\cancel{14}}}{\cancel{191}} \times \frac{753}{\underset{2}{\cancel{4}}} \times \frac{\overset{3}{\cancel{573}}}{40} = \pounds\frac{15813}{80} = \pounds197\ 13s.\ 3d.$$

(5)... $\frac{11}{14} : \frac{17}{21} = \frac{33}{42} : \frac{34}{42}$

hence $17 : 21$ is tho greater ratio

(6)... $\frac{5}{7} : \frac{7}{9} = \frac{\frac{5}{7}}{\frac{7}{9}} = \frac{5 \times 9}{7 \times 7} = \frac{45}{49}$

(7)... Sum paid per month to men

$$= \pounds1\ 5s. \times 4 \times 64 = \pounds320$$

$\therefore \pounds360 - \pounds320 = \pounds40 =$ sum paid monthly to boys

monthly wages of each boy $= 8s. \times 4 = 32s.$

$\therefore$ the number of boys $= \pounds40 \div 32s. = 800 \div 32 = 25$

$$\begin{array}{ccccccccc} \text{t.}\ \ \text{cwt.}\ \ \text{mi.} & & \text{cwt.} & \text{mi.} & & \pounds & s. & d. & \\ (8)...2\ \ 15 \times 36 & : & 2\frac{1}{2} \times 18 & \times 85 & : & 4 & 2 & 6 & : & x \\ \ \ \ \ 20 & & 2 & & & 20 & & & \\ \ \ \overline{55} & & \overline{5} & & & \overline{82} & & & \\ \ \ \ \ 2 & & & & & 12 & & & \\ \ \overline{110} & & & & & \overline{990} & & & \end{array}$$

$$x = \frac{5 \times \cancel{18} \times 85 \times \overset{9}{\cancel{990}}}{\underset{2}{\cancel{110}} \times \cancel{36}} = \frac{3825}{2}d. = \pounds7\ 19s.\ 4\frac{1}{2}d.$$

(9)...                          $13\overline{7}82\overline{3}59\overline{2}51\overline{6}(371246$
                                        9
                          $67)\ \overline{478}$
                                 469
                          $741)\ \overline{923}$
                                   741
                          $7422)\overline{18259}$
                                   14844
                          $74244)\ \overline{341525}$
                                   296976
                          $742486)\ \overline{4454916}$
                                    4454916

$\sqrt{472\tfrac{9}{121}} = \sqrt{\tfrac{57121}{121}} = \tfrac{239}{11} = 21\tfrac{8}{9}$

(10)...                          $44\overline{4}19\overline{4}94\overline{7}(763$
                    $7^3 = 343$
          $7^2 \times 300 = 14700)\overline{101194}$
                              $\overline{88200} = 14700 \times 6$
                                $7560 = 7 \times 30 \times 6^2$
                                 $216 = 6^3$
                              $\overline{95976}$ subtrahend
$76^2 \times 300 = 1732800)\ \overline{5218947}$
                              $\overline{5198400} = 1732800 \times 3$
                                $20520 = 76 \times 30 \times 3^2$
                                   $27 = 3^3$
                              $\overline{5218947}$


*EXERCISE XCII.*

             *s. d.*    *d.*
(1)...                          $3\ \ 9 = 45$
                                  $60\tfrac{1}{2}$
                                $\overline{2700}$
                                   $22\tfrac{1}{2}$
$8s.\ 3d. = 99d. \begin{cases} 9)\overline{2722\tfrac{1}{2}} \\ 11)\overline{302\tfrac{1}{2}} \end{cases}$
                              $27\tfrac{1}{2}$ yds. of velvet

(2)...

$$\left(\tfrac{5}{8} \text{ of } \frac{5\frac{3}{5}}{7\frac{1}{2}}\right) \times \left(\tfrac{1}{9} \text{ of } 4\frac{1}{8}\right)$$

$$= \frac{\cancel{5}}{\cancel{8}} \times \frac{\overset{4}{\cancel{32}}}{\underset{9}{\cancel{45}}} \times \frac{1}{\cancel{9}} \times \frac{\overset{11}{\cancel{33}}}{\underset{2}{\cancel{8}}} = \frac{11}{54};$$

$$17\tfrac{1}{4} \div 6\tfrac{3}{4} = \frac{\overset{23}{\cancel{69}}}{\cancel{4}} \times \frac{\cancel{4}}{\underset{9}{\cancel{27}}} = \frac{23}{9} = 2\tfrac{5}{9}$$

(3)...

$$\frac{13}{16} \text{ flo.} = \frac{13}{\underset{8}{\cancel{16}}} \times \frac{\overset{s.}{\cancel{2}}}{1} = \frac{13}{8} = \overset{s.}{1} \quad \overset{d.}{7\tfrac{1}{2}}$$

$$\cancel{\tfrac{11}{16}} \text{ hf. cr.} = \tfrac{11}{16} \times \tfrac{5}{3} = \tfrac{55}{38} = 1 \quad 6\tfrac{1}{3}$$
$$\text{difference} = \quad\quad 1\tfrac{1}{6}$$

(4)...

```
      29·5625
      25·725
     ───────
     1478125
     591250
    2069375
    1478125
    591250
   ──────────
  760·4953125 ·
```

$$29\cdot5625 = 29\tfrac{5625}{10000} = 29\tfrac{9}{16}$$

$$25\cdot725 = 25\tfrac{725}{1000} = 25\tfrac{29}{40}$$

$$29\tfrac{9}{16} \times 25\tfrac{29}{40} = \tfrac{473}{16} \times \tfrac{1029}{40} = \tfrac{486717}{640} = 760\tfrac{317}{640}$$

$$640\begin{cases} \dfrac{10)317}{\phantom{0}} \\ \dfrac{8)31\cdot7}{\phantom{0}} \\ \dfrac{8)3\cdot9625}{\cdot4953125} \end{cases}$$

$$\therefore 760\tfrac{317}{640} = 760\cdot4953125$$

(5)...
$$69{\cdot}15)486{\cdot}829830(7{\cdot}0402$$
$$\underline{48405}$$
$$\overline{27798}$$
$$27660$$
$$\overline{13830}$$
$$\underline{13830}$$

$$\cdot6915)486{\cdot}829830(704{\cdot}02$$
$$\underline{48405}$$
$$\overline{27798}$$
$$27660$$
$$\overline{13830}$$
$$\underline{13830}$$

(6)...1.

| | s. | d. | | | £ | s. | d. | |
|---|---|---|---|---|---|---|---|---|
| | 3 | 4 | $=\frac{1}{6}$ of £1 | | 1979 | 0 | 0 | =value at £1 per yd. |
| | | 4 | $=\frac{1}{10}$ of 3s. 4d. | | 329 | 16 | 8 | |
| | | $\frac{1}{2}$ | $=\frac{1}{8}$ of 4d. | | 32 | 19 | 8 | |
| | | | | | 4 | 2 | $5\frac{1}{2}$ | |
| | | | | | £366 | 18 | $9\frac{1}{2}$ | |

2.

| | | £ | s. | d. | |
|---|---|---|---|---|---|
| 2 qrs. $=\frac{1}{2}$ of 1 cwt. | | 2 | 10 | 0 | per cwt. |
| | | | | 11 | |
| | | 27 | 10 | 0 | |
| 7 lb. $=\frac{1}{8}$ of 2 qrs. | | 1 | 5 | 0 | |
| | | | 3 | $1\frac{1}{2}$ | |
| | | £28 | 18 | $1\frac{1}{2}$ | |

3.

| | | £ | s. | d. | |
|---|---|---|---|---|---|
| 4 bu. $=\frac{1}{2}$ of 1 qr. | | 3 | 7 | 6 | per quarter |
| | | | | 9 | |
| | | 30 | 7 | 6 | |
| 1 bu. $=\frac{1}{4}$ of 4 bu. | | 1 | 13 | 9 | |
| 2 pks. $=\frac{1}{2}$ of 1 bu. | | | 8 | $5\frac{1}{4}$ | |
| 1 pk. $=\frac{1}{2}$ of 2 pks. | | | 4 | $2\frac{5}{8}$ | |
| | | | 2 | $1\frac{5}{16}$ | |
| | | £32 | 16 | $0\frac{3}{16}$ | |

$$
\begin{array}{ccc}
& \pounds & s. & d. \\
\text{4. } 2 \text{ ro.} = \tfrac{1}{2} \text{ of 1 ac.} & 2 & 8 & 0 \text{ per acre} \\
& & & 11 \times 11 \times 3 = 363 \\
\hline
& 26 & 8 & 0 \\
& & & 11 \\
\hline
& 290 & 8 & 0 \\
& & & 3 \\
\hline
& 871 & 4 & 0 \\
1 \text{ ro.} = \tfrac{1}{2} \text{ of 2 ro.} & 1 & 4 & 0 \\
10 \text{ per.} = \tfrac{1}{4} \text{ of 1 ro.} & & 12 & 0 \\
5 \text{ per.} = \tfrac{1}{2} \text{ of 10 per.} & & 3 & 0 \\
& & 1 & 6 \\
\hline
\pounds 873 & 4 & 6 \\
\end{array}
$$

$$
\begin{array}{crcl}
& \pounds & s. & d. \\
(7)\ldots 4 \text{ per cent.} = \tfrac{1}{25} \text{ of } 100) & 347 & 16 & 3 \\
\hline
& 13 & 18 & 3 \text{ int. for 1 year} \\
& & & 2\tfrac{1}{4} \\
\hline
& 27 & 16 & 6 \\
& 3 & 9 & 6\tfrac{3}{4} \\
\hline
\pounds 31 & 6 & 0\tfrac{3}{4} \text{ int. for } 2\tfrac{1}{4} \text{ years}
\end{array}
$$

$$
(8)\ldots
\begin{array}{c}
\overset{\pounds}{73\tfrac{1}{2}} \\
2 \\
\hline
147
\end{array}
\ :\ 
\overset{\pounds}{5000}
\ ::\ 
\begin{array}{c}
\overset{\pounds}{3\tfrac{1}{2}} \\
2 \\
\hline
7
\end{array}
\ :\ \text{income required}
$$

$$
\text{income required} = \frac{5000 \times \cancel{7}}{\underset{21}{\cancel{147}}} = \pounds\frac{5000}{21} = \pounds 238 \ 1s. \ 10\tfrac{4}{7}d.
$$

$$
(9)\ldots
\begin{array}{cc}
100 & 100 \\
14 & 10 \\
\hline
86 & 110
\end{array}
$$

$$
\begin{array}{cccc}
& & \pounds & s. & d. \\
86 : 110 :: & 24 & 14 & 6 & : x \\
& & 20 \\
\hline
& 494 \\
& & 12 \\
\hline
& 5934
\end{array}
$$

$$
x = \frac{110 \times \overset{69}{\cancel{5934}}}{\underset{}{\cancel{86}}} = 7590d. = \pounds 31 \ 12s. \ 6d.
$$

(10)...    $\sqrt{136\frac{120}{169}} = \sqrt{\frac{23104}{169}} = \frac{152}{13} = 11\frac{9}{13}$;

    $\sqrt[3]{198\frac{107}{216}} = \sqrt[3]{\frac{42875}{216}} = \frac{35}{6} = 5\frac{5}{6}$;

    $\sqrt[4]{447\frac{466}{625}} = \sqrt[4]{\frac{279841}{625}} = \frac{23}{5} = 4\frac{3}{5}$


## EXERCISE XCIII.

(1)...

| £ | s. | d. |
|---|----|----|
| 1 | 17 | 9 |

$9 \times 9 \times 9 = 729$

| | | |
|---|----|----|
| 16 | 19 | 9 |
|  |  | 9 |
| 152 | 17 | 9 |
|  |  | 9 |
| £1375 | 19 | 9 |


(2)... Loss in the pound $= 20s. - 12s.\ 10\frac{1}{2}d. = 7s.\ 1\frac{1}{2}d.$

|  | £ | s. | d. |
|---|---|----|----|
| $5s. = \frac{1}{4}$ of £1 | 2456 | 16 | 8 |
| $2s. = \frac{1}{10}$ of £1 | 614 | 4 | 2 |
| $1\frac{1}{2}d. = \frac{1}{16}$ of 2s. | 245 | 13 | 8 |
|  | 15 | 7 | $1\frac{1}{4}$ |
|  | £675 | 4 | $11\frac{1}{4}$ |


(3)...

| yds. | | yds. | | £ | s. | d. | | |
|------|---|------|---|---|----|----|---|---|
| $49\frac{3}{4}$ | : | $51\frac{1}{2} \times 13$ | :: | 1 | 0 | $8\frac{3}{4}$ | : | $x$ |
| 4 |  | 4 |  | 20 |  |  |  |  |
| 199 |  | 206 |  | 20 |  |  |  |  |
|  |  |  |  | 12 |  |  |  |  |
|  |  |  |  | 248 |  |  |  |  |
|  |  |  |  | 4 |  |  |  |  |
|  |  |  |  | 995 |  |  |  |  |

$$x = \frac{206 \times 13 \times \overset{5}{\cancel{995}}}{\cancel{199}} = 13390 \text{ far.} = £13\ 18s.\ 11\frac{1}{2}d.$$

(4)...

$$\begin{array}{ccc} £ & s. & d. \\ 231 & 7 & 1\frac{1}{4} \\ & & 18 \end{array}$$

$18\frac{7}{18} \times 18 = 331)\overline{4164 \quad 7 \quad 10\frac{1}{2}}(£12 \ 11s. \ 7\frac{1}{2}d.$
$\qquad\qquad 3972$
$\qquad\qquad \overline{192}$
$\qquad\qquad\quad 20$
$\qquad 331)\overline{3847}(11s.$
$\qquad\quad 3641$
$\qquad\quad \overline{206}$
$\qquad\qquad 12$
$\qquad 331)\overline{2482}(7d.$
$\qquad\quad 2317$
$\qquad\quad \overline{165}$
$\qquad\qquad 4$
$\qquad 331)\overline{662}(2f.$
$\qquad\quad 662$
$\qquad\quad \overline{\phantom{662}}$

(5)...  1 qr. = $\frac{1}{4}$ of 1 cwt.

$$\begin{array}{ccc} £ & s. & d. \\ 3 & 19 & 4 \text{ per cwt.} \\ & & 10 \\ \hline 39 & 13 & 4 \\ & 19 & 10 \\ & 1 & 5 \\ \hline £40 & 14 & 7 \text{ value of Cheshire cheese} \end{array}$$

2 lb. = $\frac{1}{14}$ of 1 qr.

12$\frac{1}{2}$ lb. Stilton cheese at 11$\frac{1}{2}$d. = 11s. 11$\frac{3}{4}$d.

£40 14s. 7d. ÷ 11s. 11$\frac{3}{4}$d. = 68, No. of Stilton cheeses

(6)...

$$\begin{array}{ccccccc} \text{ho.} & \text{min.} & & \text{ho.} & & \text{min.} & \\ 7 & 28 & : & 1 & :: & 28 & : & x \\ & 60 & & 60 & & & \\ \hline & \overline{448} & & \overline{60} & & & \end{array}$$

$$x = \frac{\overset{15}{\cancel{60}} \times \cancel{28}}{\underset{\underset{4}{\cancel{16}}}{\cancel{448}}} = \frac{15}{4} \text{ mi.} = 3\frac{3}{4} \text{ miles per hour}$$

P

(7)...      $\frac{7}{9}$ of $\frac{8}{11}$ = $\frac{56}{99}$ = elder son's portion

$1-\frac{56}{99}$ = $\frac{43}{99}$ = younger son's portion

Difference, $\frac{56}{99}-\frac{43}{99}$ = $\frac{13}{99}$, which is = £466 1s.

$$\frac{13}{99} \;:\; 1 \;::\; \begin{array}{cc} \pounds & s. \\ 466 & 1 \end{array}$$

$$\begin{array}{r} 20 \\ \hline 9321 \end{array}$$

Value of estate = $\dfrac{99}{\cancel{13}} \times \dfrac{\overset{717}{\cancel{9321}}}{1}$ = 70983s. = £3549 3s.

Elder son's portion = $\dfrac{56}{\cancel{99}} \times \dfrac{\overset{717}{\cancel{70983}}}{1}$ = 40152s. = £2007 12s.

Younger son's portion = £3549 3s. − £2007 12s. = £1541 11s.


(8)...4 per cent. = $\frac{1}{25}$ of 100

$\frac{1}{2}$  „  „  = $\frac{1}{8}$ of 4

$$\begin{array}{rrr} \pounds & s. & d. \\ 1642 & 10 & 0 \\ \hline 65 & 14 & 0 \\ 8 & 4 & 3 \\ \hline \pounds73 & 18 & 3 \end{array} = 1 \text{ year's int.}$$

From March 10, 1861, to September 26, 1863 = 930 **days**

$$\begin{array}{ccc} \text{da.} & & \text{da.} \\ 365 & : & 930 \end{array} :: \begin{array}{ccc} \pounds & s. & d. \\ 73 & 18 & 3 \end{array} : \; x$$

$$\begin{array}{r} 20 \\ \hline 1478 \\ 12 \\ \hline 17739 \end{array}$$

$x = \dfrac{\overset{186}{\cancel{930}} \times \overset{243}{\cancel{17739}}}{\underset{\underset{73}{\cancel{73}}}{\cancel{365}}}$ = 45198d. = £188 6s. 6d.

$$
\begin{array}{lccc}
 & £ & s. & d. \\
\text{(9)...5 per cent.}=\tfrac{1}{20}\text{ of }100 | 666 & 13 & 4 \\
\quad\quad\quad\quad\quad\quad\quad\quad 33 & 6 & 8 \text{ int. for 1st year} \\
\text{,,}\quad\quad\quad\quad\text{,,} \quad\; \overline{700} & 0 & 0 \text{ prin. at end of 1st yr.} \\
\quad\quad\quad\quad\quad\quad\quad\quad 35 & 0 & 0 \text{ int. for 2nd year} \\
\text{,,}\quad\quad\quad\quad\text{,,} \quad\; \overline{735} & 0 & 0 \text{ prin. at end of 2nd yr.} \\
\quad\quad\quad\quad\quad\quad\quad\quad 36 & 15 & 0 \text{ int. for 3rd year} \\
\text{,,}\quad\quad\quad\quad\text{,,} \quad\; \overline{771} & 15 & 0 \text{ prin. at end of 3rd yr.} \\
\quad\quad\quad\quad\quad\quad\quad\quad 38 & 11 & 9 \text{ int. for 4th year} \\
\quad\quad\quad\quad\quad\quad\quad\quad \overline{810} & 6 & 9 \text{ prin. at end of 4th yr.} \\
\quad\quad\quad\quad\quad\quad\quad\quad 666 & 13 & 4 \text{ original principal} \\
\quad\quad\quad\quad\quad\quad £\overline{143} & 13 & 5 \text{ compound interest}
\end{array}
$$

$$
\begin{array}{ccccccc}
 & £ & & £ \;\; s. & & £ \\
\text{(10)...} & 840 & : & 56\;\; 14 & :: & 100 & : & 6\tfrac{3}{4}\text{ per cent.}
\end{array}
$$

### EXERCISE XCIV.

(1)...

$$
\begin{array}{r}
2)\overline{7\quad 9\quad 14\quad 18\quad 21} \\
3)\overline{7\quad 9\quad 7\quad 9\quad 21} \\
3)\overline{7\quad 3\quad 7\quad 3\quad 7} \\
7)\overline{7\quad 1\quad 7\quad 1\quad 7} \\
\overline{1\quad 1\quad 1\quad 1\quad 1}
\end{array}
$$

$$\text{L.C.M.} = 2\times 3\times 3\times 7 = 126$$

$$
\begin{array}{r}
2)\overline{7\quad 14\quad 15\quad 30} \\
7\quad\quad\;\; 15
\end{array}
$$

$$\text{L.C.D.} = 2\times 7\times 15 = 210$$

$$\therefore \tfrac{8}{7},\ \tfrac{11}{14},\ \tfrac{13}{15},\ \tfrac{23}{30} = \tfrac{180}{210},\ \tfrac{165}{210},\ \tfrac{182}{210},\ \tfrac{161}{210}$$

(2)...

$$\frac{11}{17} = \frac{11\times 21}{15\times 17} = \frac{77}{85};\quad \frac{15\frac{7}{9}}{23\frac{3}{10}} = \frac{\frac{142}{9}}{\frac{233}{10}} = \frac{142\times 10}{233\times 9} = \frac{1420}{2097};$$

$$\frac{27\frac{3}{11}}{63\frac{1}{3}} = \frac{\frac{300}{11}}{\frac{190}{3}} = \frac{300\times 3}{190\times 11} = \frac{90}{209}$$

P 2

(3)... $7\frac{5}{9} \times 2\frac{4}{5} \times \frac{11}{17} \times 2\frac{3}{9} \times 7\frac{1}{3} \times 3\frac{2}{11} \times 4\frac{5}{19} \times 1\frac{5}{7} \times 3\frac{3}{16} \times \frac{2}{17}$

$$= \frac{\overset{4}{\cancel{68}}}{\cancel{9}} \times \frac{\overset{2}{\cancel{14}}}{\cancel{5}} \times \frac{11}{17} \times \frac{19}{\underset{2}{\cancel{8}}} \times \frac{\overset{11}{\cancel{22}}}{\cancel{3}} \times \frac{\overset{7}{\cancel{35}}}{11} \times \frac{\overset{9}{\cancel{81}}}{19} \times \frac{\overset{3}{\cancel{12}}}{7} \times \frac{\cancel{51}}{\underset{4}{\cancel{16}}} \times \frac{\cancel{2}}{17}$$

$= 2079$

(4)...
|  |  | s. | d. |  | s. | d. |
|---|---|---|---|---|---|---|
| $\frac{7}{11}$ of | 17 | 5 | $=$ | | 11 | 1 |
| $\frac{3}{10}$ of | 17 | 11 | $=$ | | 5 | $4\frac{1}{2}$ |
| $\frac{5}{12}$ of | 14 | 9 | $=$ | | 6 | $1\frac{3}{4}$ |

$$£1 \quad 2 \quad 7\frac{1}{4}$$

(5)...
|  |  | ac. | ro. | per. |
|---|---|---|---|---|
| $\frac{8}{15}$ of 12 ac. 1 ro. 20 per. | $=$ | 6 | 2 | 16 |
| $\frac{23}{40}$ of 7 ac. 3 ro. ........ | $=$ | 4 | 1 | 33 |

$$\text{ac. } 2 \quad 0 \quad 23 \text{ per.}$$

(6)...
1.    $x$  :  1105  ::  43  :  65

$$x = \frac{\cancel{1105}^{17} \times 43}{\cancel{65}} = 731$$

2.  $7\frac{9}{11}$  :  $x$  ::  $34\frac{2}{5}$  :  $50\frac{7}{30}$

$$x = (7\frac{9}{11} \times 50\frac{7}{30}) \div 34\frac{2}{5}$$

$$= \frac{\overset{8}{\cancel{86}}}{\cancel{11}} \times \frac{\overset{137}{\cancel{1507}}}{\underset{6}{\cancel{30}}} \times \frac{\cancel{5}}{\underset{2}{\cancel{172}}} = \frac{137}{12} = 11\frac{5}{12}$$

3.  17·06  :  29·18  ::  $x$  :  154·654

$$x = \frac{17 \cdot 06 \times \cancel{154 \cdot 654}^{\;5 \cdot 3}}{\cancel{29 \cdot 18}} = 90 \cdot 418$$

4.  ·057  :  3·49  ::  ·01653  :  $x$

$$x = \frac{3 \cdot 49 \times \cancel{\cdot 01653}^{\;\cdot 29}}{\cancel{\cdot 057}} = 1 \cdot 0121$$

(7)...  $\begin{array}{ccccccc} \text{ac.} & & \text{ac.} & & \pounds & & \\ 1 & : & 93\frac{19}{32} & :: & 2\frac{5}{12} & : & x \end{array}$

$x = \frac{2995}{32} \times \frac{29}{12} = \pounds\frac{86855}{384} = \pounds226 \; 3s. \; 8\frac{3}{8}d.$

(8)...  75 sheep at 2 guineas each $= \pounds157 \; 10s.$

$\qquad\qquad\qquad\qquad \text{cost} = \pounds135$

$\qquad\qquad\qquad\qquad \text{profit} = \overline{\pounds22 \; 10s.}$

$\begin{array}{ccccccc} \pounds & & \pounds & s. & & & \\ 135 & : & 22 & 10 & :: & 100 & : & 16\frac{2}{3} \text{ per cent.} \end{array}$

(9)...
$\begin{array}{cccccccc} \text{yds.} & \text{in.} & & \text{yds.} & \text{in.} & & \pounds & s. & d. & \\ 27\frac{1}{2}\times24 & & : & 38\frac{3}{4}\times27 & & :: & 4 & 11 & 8 & : & x \\ 4 & & & 4 & & & 20 & & & \\ \hline 110 & & & 155 & & & 91 & & & \\ & & & & & & 12 & & & \\ & & & & & & \hline 1100 & & & \end{array}$

$x = \dfrac{155 \times \overset{9}{\cancel{27}} \times \overset{5}{\cancel{1100}}}{\underset{4}{\underset{\cancel{8}}{\cancel{110} \times \cancel{24}}}} = 6975 \text{ far.} = \pounds7 \; 5s. \; 3\frac{3}{4}d.$

(10)...
$\qquad\qquad\quad 9\overset{2}{2}4\overset{1}{4}9\overset{0}{0}3\overset{1}{2}66\overset{1}{1}7\overset{1}{6}4(9615042$
$\qquad\qquad\qquad\quad 81$
$\qquad\qquad 186)\overline{1144}$
$\qquad\qquad\qquad\; 1116$
$\qquad\qquad 1921)\;\overline{2890}$
$\qquad\qquad\qquad\;\; 1921$
$\qquad\qquad 19225)\;\overline{96932}$
$\qquad\qquad\qquad\;\; 96125$
$\qquad\qquad 1923004)\;\overline{8076617}$
$\qquad\qquad\qquad\quad\; 7692016$
$\qquad\qquad 19230082)\;\overline{38460164}$
$\qquad\qquad\qquad\quad\;\; 38460164$

## EXERCISE XCV.

(1)...

|  | | | | | $s.$ | $d.$ | | $£$ | $s$ | $d.$ |
|---|---|---|---|---|---|---|---|---|---|---|
| $43\frac{1}{2}$ yds. | Welsh Flannel | ...... | 2 | 3 | $=$ | 4 | 17 | $10\frac{1}{2}$ |
| $37\frac{1}{2}$ | ,, | Linen Sheeting | ...... | 1 | 10 | $=$ | 3 | 8 | 9 |
| 39 | ,, | Calico | .................. | 0 | $9\frac{1}{2}$ | $=$ | 1 | 10 | $10\frac{1}{2}$ |
| $17\frac{3}{4}$ | ,, | French Merino | ...... | 3 | 8 | $=$ | 3 | 5 | 1 |
| $2\frac{3}{4}$ | ,, | Silk Velvet | ............ | 7 | 6 | $=$ | 1 | 0 | $7\frac{1}{2}$ |

$$£14 \quad 3 \quad 2\frac{1}{2}$$

(2)...

A can reap $\frac{1}{5}$ in 1 day

B  ,,  $\frac{4}{25}$  ,,

C  ,,  $\frac{1}{7}$  ,,

$\therefore$ A+B+C can reap $\frac{1}{5}+\frac{4}{25}+\frac{1}{7}$ in 1 day

$$\frac{1}{5}+\frac{4}{25}+\frac{1}{7} = \frac{35+28+25}{175} = \frac{88}{175}$$

$\frac{88}{175}$ : 1 :: 1 day : $1\frac{87}{88}$ days

(3)...

$$74\cdot6875 = 74\frac{6875}{10000} = 74\frac{11}{16}$$

$3\frac{2}{3}s. \times 74\frac{11}{16} = \frac{11}{3} \times \frac{1195}{16} = \frac{13145}{48}s. = £13 \ 13s. \ 10\frac{1}{4}d.$

(4)...

6 hours $22\frac{1}{2}$ min. $= 6\cdot375$ hours

$6\cdot375)22\cdot3125(3\cdot5 = 3\frac{1}{2}$ miles per hour

$\quad\quad 19125$

$\quad\quad \overline{31875}$

$\quad\quad 31875$

(5)...

$6\frac{1}{2}$ guineas $= £6 \ 16s. \ 6d. = £6\frac{33}{40}$

$$£6\frac{33}{40} \times 2\frac{10}{21} \times 5 = \frac{\overset{13}{273}}{\underset{\underset{2}{8}}{40}} \times \frac{\overset{13}{52}}{21} \times \frac{5}{1} = £\frac{169}{2} = £84 \ 10s.$$

(6)...       $75\frac{1}{2}$ lb. at  9$d$. per lb.  = £2  16   $7\frac{1}{2}$
             $75\frac{1}{2}$ lb. at 70$s$. per cwt. = £2   7   $2\frac{1}{4}$
                                    profit =        9$s$.  $5\frac{1}{4}d$.

$\begin{array}{ccc}£ & s. & d.\\ 2 & 7 & 2\frac{1}{4}\end{array}$  :  $\begin{array}{cc}s. & d.\\ 9 & 5\frac{1}{4}\end{array}$  ::  100  :  20 per cent.

(7)...  $4$ per cent. = $\frac{1}{25}$ of 100) $\begin{array}{ccc}£ & s. & d.\\ 917 & 14 & 2\end{array}$

                                    36  14   2 int. for 1 year
                                              $6\frac{3}{4}$
                                    220   5   0
            $\frac{1}{2}$ year =  18   7   1
            $\frac{1}{4}$ year =   9   3   $6\frac{1}{2}$
                         £247  15   $7\frac{1}{2}$ int. for $6\frac{3}{4}$ years

(8)...          $\begin{array}{ccc}£ & s. & d.\end{array}$
              . 651  11   3 amount
                562  10   0 principal
                £89   1   3 int. for 3 years 4 mo.

    £89 1$s$. 3$d$.÷$3\frac{1}{3}$ = £26 14$s$. $4\frac{1}{2}d$. int. for 1 year

$\begin{array}{cc}£ & s.\\ 562 & 10\end{array}$ : $\begin{array}{c}£\\ 100\end{array}$ :: $\begin{array}{ccc}£ & s. & d.\\ 26 & 14 & 4\frac{1}{2}\end{array}$ :: $\begin{array}{c}£\\ 4\frac{3}{4}\end{array}$ per cent.

(9)...              3·0000000000(1·73205 . . . . .
                      1
                27)200
                   189
                343) 1100
                     1029
                3462)  7100
                       6924
                346405) 1760000
                        1732025
                          27975

(10)...
$$\text{Let } x = \text{the mean proportional}$$
$$\text{then } 108 \quad : \quad x \quad :: \quad x \quad : \quad 243$$
$$\therefore \ x^2 = 108 \times 243$$
$$= 26244$$
$$\text{and } x = 162$$

## *EXERCISE XCVI.*

(1)...

$$
\begin{array}{r}
2)\overline{7\ \ 10\ \ 14\ \ 18\ \ 25} \\
5)\overline{7\ \ \ 5\ \ \ 7\ \ \ 9\ \ 25} \\
7)\overline{7\ \ \ 1\ \ \ 7\ \ \ 9\ \ \ 5} \\
\overline{1\ \ \ 1\ \ \ 1\ \ \ 9\ \ \ 5}
\end{array}
$$

$$\text{L.C.M.} = 2 \times 5 \times 7 \times 9 \times 5 = 3150$$

(2)...

$$5\tfrac{2}{9} - (\tfrac{7}{11} \text{ of } \tfrac{5}{9} \text{ of } 4\tfrac{5}{7})$$

$$5\tfrac{2}{9} - \left( \frac{7}{\cancel{11}} \times \frac{5}{\cancel{9}} \times \frac{\cancel{33}^{3}}{7} \right)$$

$$5\tfrac{2}{9} - \tfrac{5}{3} = 5\tfrac{2}{9} - 1\tfrac{6}{9} = 3\tfrac{5}{9}$$

(3)...

$$\frac{72\tfrac{4}{9}}{84} = \frac{652}{756} = \frac{163}{189}; \qquad \frac{88}{100\tfrac{4}{5}} = \frac{440}{504} = \frac{55}{63}$$

$$\frac{72\tfrac{4}{9}}{84} \div \frac{88}{100\tfrac{4}{5}} = \frac{163}{\cancel{189}} \times \frac{\cancel{63}}{55} = \frac{163}{165}$$

(4)...

$$\left( \frac{1}{14} \text{ of } \frac{13}{24} \right) \text{ gui. } = \frac{1}{\cancel{14}} \times \frac{13}{\cancel{24}} \times \frac{\cancel{252}}{1} = \frac{39}{4}d. = 9\tfrac{3}{4}d.$$

$$9\tfrac{3}{4}d. = 39 \text{ farthings} \qquad \frac{39}{120} = \frac{13}{40} \text{ of half-a-crown}$$
$$2s. \ 6d. = 120 \quad \text{,,}$$

(5)...

$$\frac{13}{28}\text{gui.} = \frac{13}{\cancel{28}}\times\frac{\overset{3}{\cancel{21}}}{1} = \frac{39}{4} = 9s.\ 9d.$$

$$12\overline{)9}$$
$$20\overline{)9\cdot75}$$

$$9s.\ 9d. = \cdot 4875 \text{ of a sov.}$$

a sovereign $= \frac{20}{21}$ of a guinea

$$\therefore \frac{7}{32}\text{ sov.} = \frac{7}{\cancel{32}}\times\frac{\overset{5}{\cancel{20}}}{\cancel{21}} = \frac{5}{24} \text{ of a guinea}$$

(6)...

$$52\tfrac{1}{2}\text{ lb. Coffee at } 14d. = 735d.$$
$$2s.\ 11d.\times 75\times 7 = 18375d.$$
$$18375 \div 735 = 25 \text{ bags}$$

(7)...

| men | da. | hrs. | | men | da. | hrs. | | £ | s. | d. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $5\times9\times8\tfrac{1}{2}$ | | | : | $11\times13\tfrac{1}{2}\times10$ | | | :: | 9 | 11 | 3 | : | $x$ |
| 2 | 2 | | | 2 | 2 | | | 20 | | | | |
| $\overline{18}$ | $\overline{17}$ | | | $\overline{27}$ | $\overline{20}$ | | | $\overline{191}$ | | | | |
| | | | | | | | | 12 | | | | |
| | | | | | | | | $\overline{2295}$ | | | | |

$$x = \frac{11\times\cancel{27}\times\cancel{20}\times\cancel{2295}}{\cancel{5}\times\cancel{18}\times\cancel{17}} = 8910d. = £37\ 2s.\ 6d.$$

(8)...

$$86\tfrac{5}{8} - 77 = 9\tfrac{5}{8} = \text{gain upon } £77$$

$$77\ :\ 1325\ ::\ 9\tfrac{5}{8}\ :\ \text{whole gain}$$

$$\text{whole gain} = \frac{1}{\cancel{77}}\times\frac{1325}{1}\times\frac{\cancel{77}}{8} = £\frac{1325}{8} = £165\ 12s.\ 6d.$$

$$
\begin{array}{ccc}
 & s. & d. \\
\end{array}
$$

(9)...

$$
\begin{array}{rcc}
 & 4 & 8 \text{ per square yard} \\
 & & 5 \times 9 = 45 \\
\hline
1 & 3 & 4 \\
 & & 9 \\
\hline
10 & 10 & 0 \\
\end{array}
$$

4 sq. ft. 72 sq. in. $= \frac{1}{2}$ yd. $=$    2    4  
1 sq. ft. 18 sq. in. $= \frac{1}{8}$ yd. $=$       7

$$\pounds 10 \quad 12 \quad 11$$


(10)...

$$20\cdot000000000000(2\cdot7144\ldots.$$

$$8$$

$$2^2 \times 300 = 1200\overline{)\,12000}$$

$$8400 = 1200 \times 7$$

$$2940 = 2 \times 30 \times 7^2$$

$$343 = 7^3$$

$$\overline{11683} \text{ subtrahend}$$

$$27^2 \times 300 = 218700\overline{)\quad 317000}$$

$$218700 = 218700 \times 1$$

$$810 = 27 \times 30 \times 1^2$$

$$1 = 1^3$$

$$\overline{219511} \text{ subtrahend}$$

$$271^2 \times 300 = 22032300\overline{)\;97489000}$$

$$88129200 = 22032300 \times 4$$

$$130080 = 271 \times 30 \times 4^2$$

$$64 = 4^3$$

$$\overline{88259344} \text{ subtrahend}$$

$$2714^2 \times 300 = 2209738800\overline{)9229656000}$$

$$8838955200 = 2209738800 \times 4$$

$$1302720 = 2714 \times 30 \times 4^2$$

$$64 = 4^3$$

$$\overline{8840257984} \text{ subtrahend}$$

$$\overline{389398016}$$

## EXERCISE XCVII.

(1)... $\dfrac{7}{9}+\dfrac{5}{14}+\dfrac{11}{12} = \dfrac{196+90+231}{252} = \dfrac{517}{252} = 2\frac{13}{252}$

$3\frac{7}{12}-2\frac{13}{252} = 3\frac{147}{252}-2\frac{13}{252} = 1\frac{134}{252} = 1\frac{67}{126}$

(2)...

$$
\begin{array}{r}
\pounds \quad s. \quad d. \\
39 \quad 6 \quad 11 \\
7\times 8+3 = 59 \\
\hline
275 \quad 8 \quad 5 \\
8 \\
\hline
2203 \quad 7 \quad 4 \\
118 \quad 0 \quad 9 \\
\tfrac{7}{14}\ \text{or}\ \tfrac{1}{2} = \quad 19 \quad 13 \quad 5\tfrac{1}{2} \\
\tfrac{2}{14}\ \text{or}\ \tfrac{1}{7} = \quad 5 \quad 12 \quad 5 \\
\hline
\pounds 2346 \quad 13 \quad 11\tfrac{1}{2}
\end{array}
$$

(3)...

$$
\begin{array}{r}
\pounds \quad s. \quad d. \\
1107 \quad 0 \quad 9\tfrac{1}{2} \\
16
\end{array}
$$

$43\frac{3}{16}\times 16 = 691)\overline{17712\ 12\ \ 8}(\pounds 25\ 12s.\ 8d.$

$$
\begin{array}{r}
1382 \\
\hline
3892 \\
3455 \\
\hline
437 \\
20 \\
691)\overline{8752}(12s. \\
8292 \\
\hline
460 \\
12 \\
691)\overline{5528}(8d. \\
5528 \\
\hline
\end{array}
$$

(4)...
$$29{\cdot}73)782{\cdot}46000(26{\cdot}318\ldots\ldots$$
$$5946$$
$$\overline{18786}$$
$$17838$$
$$\overline{9480}$$
$$8919$$
$$\overline{5610}$$
$$2973$$
$$\overline{26370}$$
$$23784$$
$$\overline{2586}$$

$${\cdot}2973)78{\cdot}2460000(263{\cdot}188\ldots\ldots$$
$$5946$$
$$\overline{18786}$$
$$17838$$
$$\overline{9480}$$
$$8919$$
$$\overline{5610}$$
$$2973$$
$$\overline{26370}$$
$$23784$$
$$\overline{25860}$$
$$23784$$
$$\overline{2076}$$

(5)...
cwt.
7 cwt. 2 qrs. = 7·5
·6875
34375
48125
5·15625 cwt. = 5 cwt. 17½ lb.

|   |   |
|---|---|
| 4 | lb. |
| ·62500 | 28)14 |
| 28 | 4) 3·5 |
| 17·50000 lb. | 20) 5·875 |
| 16 | 5 cwt. 3 qrs. 14 lb. = ·29375 of a ton |
| 8·00000 oz. | |

```
                                 s.  d.       £    s.
(6)...              220 qrs. at 51  0  =    561   0
                    350 qrs. at 52  6  =    918  15
                    180 qrs. at 54  0  =    486   0
                                            £1965 15  selling price
                    750 qrs. at 47  6  =   1781   5   cost price
                                            £184  10  profit
```

```
                                 s.  d.     £    s.  d.
(7)...              80 lb. of tea at 3 10 = 15   6   8
                                  cost 13   6   8
                                       £2   0   0
```

```
  £   s.  d.      £
  13  6   8   :   2   ::   100   :   15 per cent.
```

```
                                        £   s.   d.
        112 lb. of sugar at 5½d. =  2  11   4
                              cost  2   6   8
                            profit      4   8
```

```
  £  s.  d.       s.  d.
  2  6   8   :   4   8  ::   100   :   10 per cent.
```

The tea yields 15 per cent. profit, and the sugar 10 per cent.

```
                            £   s.   d.
(8)...              107  11   4  amount
                     96   0  10  principal
                    £11  10   6  interest
```

```
                                 £   s.  d.
4 per cent. = 1/25 of 100 | 96   0  10
½ per cent. = ⅛ of 4      |  3  16  10
                          |      9   7¼
                           £4   6   5¼  interest for 1 year
```

```
£  s.  d.       £   s.  d.      yr.         yrs.
4  6   5¼  :   11  10   6   ::   1    :    2⅔ = 2 yrs. 8 mo.
```

```
(9)...              6513466506602̇5(8070605
                    64
          1607) 11346
                11249
        161406)  976506
                 968436
      16141205)  80706025
                 80706025
```

(10)...    Let $x$ = the mean proportional

Then 47  :  $x$  ::  $x$  :  $105\frac{3}{4}$

$$\therefore \quad x^2 = 47 \times 105\frac{3}{4}$$
$$= 4970 \cdot 25$$
$$\text{and } x = 70 \cdot 5 = 70\frac{1}{2}$$

## EXERCISE XCVIII.

(1)...

| mi. | | mi. | | ho. | min. | | |
|---|---|---|---|---|---|---|---|
| $7\frac{1}{2}$ | : | $26\frac{1}{2}$ | :: | 4 | 45 | : | $x$ |
| 2 | | 2 | | | 60 | | |
| $\overline{15}$ | | $\overline{53}$ | | $\overline{285}$ | | | |

$$x = \frac{53 \times \cancel{285}^{19}}{\cancel{15}} = 1007 \text{ min.} = 16 \text{ hrs. } 47 \text{ min.}$$

(2)...

| cwt. | qrs. | lb. | | cwt. | qrs. | lb. | | £ | s. | d. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 2 | 18 | : | 2 | 3 | 22 | :: | 31 | 12 | 1 | : | $x$ |
| | | 4 | | | | 4 | | | | 20 | | |
| | $\overline{14}$ | | | | $\overline{11}$ | | | | $\overline{632}$ | | | |
| | | 28 | | | | 28 | | | | 12 | | |
| $\overline{410}$ | | | | $\overline{330}$ | | | | $\overline{7585}$ | | | | |

$$x = \frac{\cancel{330}^{33} \times \cancel{7585}^{185}}{\cancel{410}_{41}} = 6105d. = £25 \ 8s. \ 9d.$$

(3)...

$$19 \cdot 234$$
$$\cdot 7 \cdot 465$$
$$\overline{11 \cdot 769}$$
$$\cdot 0065$$
$$\overline{58845}$$
$$70614$$
$$\overline{\cdot 0764985}$$

(4)...    $£13\frac{5}{12} = £13 \ 8s. \ 4d.$        $3 \cdot 0625 = 3\frac{1}{16}$

| | £ | s. | d. |
|---|---|---|---|
| | 13 | 8 | 4 |
| | | | 3 |
| | $\overline{40}$ | $\overline{5}$ | $\overline{0}$ |
| $\frac{1}{16} =$ | | 16 | $9\frac{1}{4}$ |
| | $\overline{£41}$ | $\overline{1}$ | $\overline{9\frac{1}{4}}$ |

$$(5)...\ 1.$$

|  | £ | s. | d. |
|---|---|---|---|
| 2 qrs. = ½ of 1 cwt. | 1 | 17 | 4 per cwt. |
|  |  |  | 7 |
|  | 13 | 1 | 4 |
| 14 lb. = ¼ of 2 qrs. |  | 18 | 8 |
| 4 lb. = 1/14 of 2 qrs. |  | 4 | 8 |
|  |  | 1 | 4 |
|  | £14 | 6 | 0 |

$$2.$$

|  | £ | s. | d. |
|---|---|---|---|
| 10 cwt. = ½ of 1 ton | 0 | 13 | 4 per ton |
|  |  | 5 × 5 = 25 |  |
|  | 3 | 6 | 8 |
|  |  |  | 5 |
|  | 16 | 13 | 4 |
| 1¼ cwt. = ⅛ of 10 cwt. |  | 6 | 8 |
| ½ cwt. = 1/20 of 10 cwt. |  |  | 10 |
|  |  |  | 4 |
|  | £17 | 1 | 2 |

$$3.$$

|  | £ | s. | d. |
|---|---|---|---|
| 44 guineas = | 46 | 4 | 0 per acre |
|  |  | 3 × 6 + 1 = 19 |  |
|  | 138 | 12 | 0 |
|  |  | 6 |  |
|  | 831 | 12 | 0 |
| 2 roods = ½ of 1 acre | 46 | 4 | 0 |
| 1 rood = ½ of 2 roods | 23 | 2 | 0 |
| 20 poles = ½ of 1 rood | 11 | 11 | 0 |
| 10 poles = ½ of 20 poles | 5 | 15 | 6 |
| 2½ poles = ¼ of 10 poles | 2 | 17 | 9 |
|  |  | 14 | 5¼ |
|  | £921 | 16 | 8¼ |

$$(6)...$$

$$35\tfrac{7}{10} \text{ E. ells} = \frac{357}{\cancel{10}_2} \times \frac{\cancel{5}}{4} = \frac{357}{8} = 44\tfrac{5}{8} \text{ yards}$$

$$44\tfrac{5}{8} \text{ yds.} \div 3\tfrac{3}{16} \text{ yds.} = \frac{\cancel{357}^7}{\cancel{8}} \times \frac{\cancel{16}^2}{\cancel{51}} = 14 \text{ shirts}$$

(7)...
$$·5625 = 6\tfrac{3}{4}d.$$
$$\begin{array}{r}·5625 \\ 12 \\ \hline 6·7500d. \\ 4 \\ \hline 3·0000 \text{ far.}\end{array}$$

cwt.
$$·578125 = 2 \text{ qrs. 8 lb. 12 oz.}$$
$$\begin{array}{r}·578125 \\ 4 \\ \hline 2·312500 \text{ qrs.} \\ 28 \\ \hline 8·750000 \text{ lb.} \\ 16 \\ \hline 12·000000 \text{ oz.}\end{array}$$

$$\begin{array}{ccccccc} \text{oz.} && \text{qr. lb. oz.} && d. \\ 3 &:& 2 \;\; 8 \;\; 12 &:& 6\tfrac{3}{4} &:& x \\ && 28 && 4 \\ \cline{3-3}\cline{5-5} && 64 && 27 \\ && 16 \\ \cline{3-3} && 1036 \end{array}$$

$$x = \frac{1036 \times \overset{9}{\cancel{27}}}{\cancel{3}} = 9324 \text{ far.} = £9 \; 14s. \; 3d.$$

(8)...Amount of £100 in $3\tfrac{1}{3}$ years at 5 per cent. per annum
$$= £100 + (£5 \times 3\tfrac{1}{3}) = £116 \; 13s. \; 4d.$$

$$\begin{array}{ccccccccc} £ & s. & d. && £ & s. & d. && £ && £ & s. & d. \\ 116 & 13 & 4 &:& 482 & 5 & 5 &::& 100 &:& 413 & 7 & 6 \end{array}$$

(9)...

|  | £ | s. | d. |  |
|---|---|---|---|---|
| $\tfrac{1}{2}$ year's int. at 5 per cent. = | 400 | 0 | 0 | principal |
|  | 10 | 0 | 0 | int. for 1st half-year |
|  | 410 | 0 | 0 | prin. at end of 1st hf.-yr. |
| " " | 10 | 5 | 0 | int. for 2nd half-year |
|  | 420 | 5 | 0 | prin. at end of 2nd hf.-yr. |
| " " | 10 | 10 | $1\tfrac{1}{2}$ | int. for 3rd half-year |
|  | 430 | 15 | $1\tfrac{1}{2}$ | prin. at end of 3rd hf.-yr. |
| " " | 10 | 15 | $4\tfrac{43}{80}$ | int. for 4th half-year |
|  | 441 | 10 | $6\tfrac{3}{80}$ | prin. at end of 4th hf.-yr. |
| " " | 11 | 0 | $9\tfrac{483}{3200}$ | int. for 5th half-year |
|  | £452 | 11 | $3\tfrac{603}{3200}$ | amount in $3\tfrac{1}{2}$ years |

(10)...        $\frac{7}{12}$ = ·583333333333......(·763762......
                    49
          146) 933
               876
            1523) 5733
                  4569
            15267)116433
                  106869
          152746)  956433
                   916476
          1527522)  3995733
                    3055044
                     940689

*EXERCISE XCIX.*

(1)...        5989)7571(1
                  5989
                  1582)5989(3
                       4746
                       1243)1582(1
                            1243
                            339)1243(3
                                1017
                                226)339(1
          113)8927(79              226
               791                 113)226(2
               1017                     226
               1017

              G.C.M. = 113

                2)6   8   9  12  14  18  21
                2)3   4   9   6   7   9  21
                3)3   2   9   3   7   9  21
                3)1   2   3   1   7   3   7
                7)1   2   1   1   7   1   7
                  1   2   1   1   1   1   1

        L.C.M. = 2 × 2 × 3 × 3 × 7 × 2 = 504
                        Q

(2)...  $3\frac{2}{7} \times \frac{9}{10} \times 1\frac{5}{9} \times 2\frac{6}{7} \times \frac{8}{11} \times 1\frac{5}{23} \times 1\frac{2}{5} \times \frac{11}{16}$

$$= \frac{23}{7} \times \frac{9}{10} \times \frac{14}{9} \times \frac{20}{7} \times \frac{8}{11} \times \frac{15}{23} \times \frac{7}{5} \times \frac{11}{16}$$

$$= 6$$

(3)...  $10\frac{1}{2} \div (\tfrac{4}{7} \text{ of } \tfrac{5}{8})$

$$= \frac{21}{2} \times \frac{7}{4} \times \frac{8}{5} = \frac{147}{5} = 29\frac{2}{5}$$

(4)...  11s. 1d. = 133 pence

1 guinea = 252 pence

$\frac{133}{252} + 7 = \frac{19}{36}$ of a guinea

$\frac{77}{96}$ sov. $= \frac{77}{96} \times \frac{20}{1} = \frac{385}{24}$ s. $=$ 16s. $0\frac{1}{2}$d.

(5)...

$\frac{13}{18}$ gui. $= \frac{13}{18} \times \frac{21}{1} = \frac{91}{6} =$    15    2   (s. d.)

$\frac{19}{24}$ sov. $= \frac{19}{24} \times \frac{20}{1} = \frac{95}{6} =$    15   10

$\frac{7}{12}$ cr. $= \frac{7}{12} \times \frac{5}{1} = \frac{35}{12} =$    2   11

$\frac{13}{16}$ fl. $= \frac{13}{16} \times \frac{2}{1} = \frac{13}{8} =$    1   $7\frac{1}{2}$

$\frac{29}{48} =$    $7\frac{1}{4}$

£1 16 $1\frac{3}{4}$

(6)...

$$\frac{7}{16} \text{ yard} = \frac{7}{\cancel{16}_4} \times \frac{\cancel{36}^9}{1} = \frac{63}{4} \text{ in.} = 15\frac{3}{4} \text{ in.}$$

$$\frac{13}{24} \text{ foot} = \frac{13}{\cancel{24}_2} \times \frac{\cancel{12}}{1} = \frac{13}{2} \text{ in.} = \begin{array}{l} 6\frac{1}{2} \text{ in.} \\ 9\frac{1}{4} \text{ inches} \end{array}$$

(7)...

$$1 \text{ sov.} = \tfrac{20}{21} \text{ of a guinea}$$

$$\therefore \frac{35}{48} \text{ sov.} = \frac{\cancel{35}^5}{\cancel{48}_{12}} \times \frac{\cancel{20}^5}{\cancel{21}_3} = \frac{25}{36} \text{ of a guinea}$$

$$1 \text{ guinea} = \tfrac{21}{20} \text{ of a sovereign}$$

$$\therefore \frac{35}{48} \text{ gui.} = \frac{\cancel{35}^7}{\cancel{48}_{16}} \times \frac{\cancel{21}^7}{\cancel{20}_4} = \frac{49}{64} \text{ of a sovereign}$$

(8)...

$$\frac{19}{32} \text{ cwt.} = \frac{19}{\cancel{32}_2} \times \frac{\cancel{112}^7}{1} = \frac{133}{2} = 66\frac{1}{2} \text{ lb.}$$

$$\begin{array}{cccccc} \text{lb.} & & \text{lb.} & & \pounds & \\ 17\frac{5}{8} & : & 66\frac{1}{2} & :: & \tfrac{107}{160} & : & x \end{array}$$

$$x = \frac{\cancel{8}^3}{\cancel{107}} \times \frac{133}{2} \times \frac{\cancel{107}}{\cancel{160}_{80}} = \pounds\frac{399}{160} = \pounds2 \text{ } 9s. \text{ } 10\frac{1}{2}d.$$

(9)...  A + B can reap $\tfrac{2}{25}$ of an acre in 1 hour

A can reap $\tfrac{2}{45}$  ,,   ,,   ,,

$$\therefore \text{ B can reap } \frac{2}{25} - \frac{2}{45} = \frac{18-10}{225} = \frac{8}{225} \text{ in 1 hour}$$

B would reap an acre in $\tfrac{225}{8} = 28\frac{1}{8}$ hours

$$(10)\ldots\quad \begin{array}{cc}\text{yd.} & \text{in.}\\ 1\tfrac{7}{8}\text{ or }67\tfrac{1}{2}\end{array} \ :\ \begin{array}{c}\text{in.}\\25\end{array}\ ::\ \begin{array}{c}\text{yds.}\\47\tfrac{1}{4}\end{array}\ :\ x$$

$$x = \frac{\cancel{2}}{\cancel{135}}\times\frac{\overset{5}{\cancel{25}}}{1}\times\frac{\overset{7}{\cancel{189}}}{\underset{2}{\cancel{4}}} = \frac{35}{2}\text{ yds.} = 17\tfrac{1}{2}\text{ yards}$$

## EXERCISE C.

(1)...Time occupied in walking $= 35 \div 3\tfrac{3}{4} = 9$ hrs. 20 min.

9 hrs. 20 min. + 20 min. + 15 min. = 9 hrs. 55 min.

|  | hrs. | min. |  |
|---|---|---|---|
| Time of starting | 6 | 30 | A. M. |
| Time occupied by journey | 9 | 55 |  |
| Time of arrival at Henley | 4 | 25 | P. M. |

(2)...

```
   66564(258              258)123582(479
   4                          1032
45)265                        ─────
   225                        2038
508) 4064                     1806
     4064                     ─────
                              2322
                              2322
```

∴ the numbers are 258 and 479

(3)... $\cdot072 = \tfrac{72}{1000} = \tfrac{9}{125}$; $\cdot1065 = \tfrac{1065}{10000} = \tfrac{213}{2000}$;

$\cdot00625 = \tfrac{625}{100000} = \tfrac{1}{16}$

(4)...

```
17·1875s. = 17s. 2¼d.          5·3125 cr. = 26s. 6¾d.
12                             5
───────                        ───────
2·2500d.                       1·5625s.
4                              12
───────                        ───────
1·0000 far.                    6·7500d.
                               4
                               ───────
                               3·0000 far.
```

26s. 6¾d. − 17s. 2¼d. = 9s. 4½d.

(5)...

$$24\overline{)12}^{\text{grs.}}$$
$$20\overline{)10 \cdot 5}$$
$$12\overline{)\ 6 \cdot 525}$$

6 oz. 10 dwts. 12 grs. = ·54375 of a lb. Troy

(6)... Perimeter of field = $(216 + 146) \times 2 = 724$ yards

724 yards at 1s. 2½d. per yard = £43 14s. 10d.

(7)...

| men da. | | men da. | | ac. per. | | |
|---|---|---|---|---|---|---|
| $5 \times 4\frac{1}{2}$ | : | $9 \times 3\frac{3}{4}$ | :: | 14  10 | : | $x$ |
| 4 | | 4 | | 160 | | |
| $\overline{18}$ | | $\overline{15}$ | | $\overline{2250}$ | | |

$$x = \frac{9 \times \overset{3}{\cancel{15}} \times \overset{125}{\cancel{2250}}}{\cancel{5} \times \cancel{18}} = 3375 \text{ perches} = 21 \text{ ac. } 15 \text{ per.}$$

(8)...

| £ | | £ | | £ | | |
|---|---|---|---|---|---|---|
| $93\frac{1}{2}$ | : | 1650 | :: | $4\frac{1}{4}$ | : | yearly income |
| 4 | | | | 4 | | |
| $\overline{374}$ | | | | $\overline{17}$ | | |

$$\text{yearly income} = \frac{\overset{75}{\cancel{1650}} \times \cancel{17}}{\underset{\cancel{22}}{\cancel{374}}} = £75$$

(9)... 5s. 3d. per dozen = 63s. per gross

$$\phantom{\text{profit} = } 45s.$$
$$\text{profit} = \overline{18s.} \text{ per gross}$$

| s. | | s. | | | | |
|---|---|---|---|---|---|---|
| 45 | : | 18 | :: | 100 | : | gain per cent. |

$$\text{gain} = \frac{\overset{2}{\cancel{18}} \times \overset{20}{\cancel{100}}}{\underset{\cancel{5}}{\cancel{45}}} = 40 \text{ per cent.}$$

(10)...
$$
\begin{array}{r}
714285283716(845154 \\
64 \phantom{0000000000}
\end{array}
$$

$$
\begin{array}{r}
164)\ \overline{742} \\
656
\end{array}
$$

$$
\begin{array}{r}
1685)\ \overline{8685} \\
8425
\end{array}
$$

$$
\begin{array}{r}
16901)\ \overline{26028} \\
16901
\end{array}
$$

$$
\begin{array}{r}
169025)\ \overline{912737} \\
845125
\end{array}
$$

$$
\begin{array}{r}
1690304)\ \overline{6761216} \\
6761216
\end{array}
$$

## EXERCISE CI.

(1)...

$$
\begin{array}{cc}
s. & d. \\
23 & 6 \\
& 7 \times 9 = 63 \\
\hline
164 & 6 \\
& 9 \\
\hline
21)\,1480 & 6
\end{array}
$$

70½ gallons of brandy *and water*
63 gallons of brandy
7½ gallons of water

(2)...

$$
\begin{array}{ccccccccc}
\text{ac.} & & \text{ac.} & \text{ro.} & \text{per.} & & s. & & \\
1 & : & 237 & 3 & 20 & :: & 42 & : & x \\
4 & & 4 & & & & & & \\
\hline
4 & & 951 & & & & & & \\
40 & & 40 & & & & & & \\
\hline
160 & & 38060 & & & & & &
\end{array}
$$

$$
\begin{array}{cc}
1903 & 21
\end{array}
$$

$$
x = \frac{38060 \times 42}{100} = \frac{39963}{4}s. = \pounds499\ 10s.\ 9d.
$$

$$
\begin{array}{c}
8 \\
4
\end{array}
$$

$$
\begin{array}{cccc}
& \pounds & s. & d. \\
1s.\ 8d. = \tfrac{1}{12}\ \text{of}\ \pounds 1)\,499 & 10 & 9 & \text{rent of land} \\
\hline
\pounds 41 & 12 & 6\tfrac{3}{4} & \text{amount of poor rate}
\end{array}
$$

(3)...
$$
\begin{array}{r}
\pounds \quad s. \\
4)\overline{50 \quad 0} \text{ cost of 4 cows} \\
\overline{12 \quad 10} \text{ cost of 1 cow} \\
7 \\
5)\overline{87 \quad 10} \text{ value of 7 cows or 5 horses} \\
\overline{17 \quad 10} \text{ value of 1 horse} \\
8 \\
\pounds\overline{140 \quad 0} \text{ value of 8 horses}
\end{array}
$$

(4)...
$$
\frac{\overset{95}{\cancel{475}} \times \overset{7}{\cancel{273}}}{\underset{\underset{39}{\cancel{39}}}{\cancel{195}}} = 665 \text{ yards}
$$

(5)...
$$\cdot 09375 \quad : \quad \cdot 425 \quad :: \quad \overset{\pounds}{826\cdot 875} \quad : \quad x$$

$$x = \frac{\cdot 425 \times \overset{8820}{\cancel{826\cdot 875}}}{\cancel{\cdot 09375}} = \pounds 3748\cdot 5 = \pounds 3748 \ 10s.$$

(6)...
$$
\overset{\text{yds.}}{7\tfrac{7}{8}} \ : \ \overset{\text{yds.}}{19\cdot 2375} = \overset{\text{yds.}}{19\tfrac{19}{80}} \ : \ \overset{\pounds \ s. \ d.}{3 \ 18 \ 9} = \overset{\pounds}{3\tfrac{15}{16}} \ : \ x
$$

$$x = \frac{\cancel{8}}{\cancel{63}} \times \frac{1539}{\underset{10}{\cancel{80}}} \times \frac{\cancel{63}}{16} = \pounds\frac{1539}{160} = \pounds 9 \ 12s. \ 4\tfrac{1}{2}d.$$

(7)...     From May 1st to Dec. 6th = 219 days

$$
\begin{array}{c}
\overset{\pounds \quad\ \text{da.}}{125 \times 365} \quad : \quad \overset{\pounds \quad\ \text{da.}}{550 \times 219} \quad :: \quad \overset{\pounds \ s. \ d.}{5 \ 12 \ 6} \quad : \quad x \\
20 \\
\overline{112} \\
12 \\
\overline{1350}
\end{array}
$$

$$x = \frac{\overset{22}{\cancel{550}} \times \overset{3}{\cancel{219}} \times \overset{54}{\overset{270}{\cancel{1350}}}}{\underset{\cancel{5}}{\cancel{125}} \times \underset{\cancel{5}}{\cancel{365}}} = 3564d. = \pounds 14 \ 17s.$$

(8)...        $\overset{\pounds}{3\frac{1}{2}}$ :   $\overset{\pounds}{150}$ :: $\overset{\pounds}{73\frac{1}{2}}$ :   required sum

required sum $= \frac{\cancel{7}}{7} \times \frac{150}{1} \times \frac{\overset{21}{\cancel{147}}}{\cancel{7}} = \pounds3150$

(9)...    11  :   15 $= \frac{11}{15}$; $3\frac{5}{8}$ :   $4\frac{13}{16} = \frac{3\frac{5}{8}}{4\frac{13}{16}} = \frac{58}{77}$;

$2\cdot75$ :   $3\cdot85 = \frac{2\cdot75}{3\cdot85} = \frac{5}{7}$

$\frac{11}{15}, \frac{58}{77}, \frac{5}{7} = \frac{847}{1155}, \frac{870}{1155}, \frac{825}{1155}$

∴ the ratio of $3\frac{5}{8}$ :   $4\frac{13}{16}$, to which $\frac{870}{1155}$ corresponds, is the greatest

(10)...        7 : 9 $= \frac{7}{9}$; 15 : 21 $= \frac{15}{21} = \frac{5}{7}$

$\frac{7}{9} \times \frac{5}{7} = \frac{5}{9} = 5 : 9$;

. 5 : 8 $= \frac{5}{8}$; 8 : 15 $= \frac{8}{15}$; 15 : 32 $= \frac{15}{32}$

$\frac{5}{\cancel{8}} \times \frac{\cancel{8}}{\cancel{15}} \times \frac{\cancel{15}}{32} = \frac{5}{32} = 5 : 32$

*Ans.* 5 : 9; and 5 : 32

### EXERCISE CII.

(1)...        3 cows at £10 15s. each $=$ $\overset{\pounds}{32}$ $\overset{s.}{5}$
18 sheep at 36s. each $=$ 32  8
sum received $= \overline{\pounds64\ \ 13}$

|  | £ | s. | d. |
|---|---|---|---|
| Grocer's Bill ........................ | 13 | 14 | 6 |
| 7½ yds. Cloth   at 10s. 6d. $=$ | 3 | 18 | 9 |
| 18½  „  Merino at 2s. 3d. $=$ | 2 | 1 | 7½ |
| 2  prs. Blankets at 13s. 6d. $=$ | 1 | 7 | 0 |
| sum paid $=$ | $\overline{\pounds21}$ | 1 | 10½ |

∴ he took home £64 13s.—£21 1s. 10½d. $=$ £43 11s. 1½d.

|          |                                          | s.  | d.  | £ | s. | d. |
|----------|------------------------------------------|-----|-----|---|----|-----|

(2)...    $1\frac{7}{8}$ yds. Black Cloth .........18   6 = 1 14  $8\frac{1}{4}$
      $2\frac{1}{4}$  ,,   do.    do.  .........14  6 = 1 12  $7\frac{1}{2}$
      $2\frac{1}{2}$  ,,  Doeskin............... 6  9 = 0 16  $10\frac{1}{2}$
  $18\frac{3}{4}$  ,,  Welsh Flannel...... 1 10 = 1 14  $4\frac{1}{2}$
  1 Silk Umbrella  ........................ 0 15  6
  1 Alpaca  do.   ........................ 0  8  6
                                £7  2  $6\frac{3}{4}$

(3)...
$$\frac{4\frac{2}{3}}{5\frac{1}{4}}+\frac{3\frac{3}{7}}{6\frac{2}{9}}+\frac{2\frac{4}{5}}{10\frac{1}{2}} = \frac{8}{9}+\frac{27}{49}+\frac{4}{15}$$

$$= \frac{1960+1215+588}{2205}$$

$$= \frac{3763}{2205} = 1\frac{1558}{2205}$$

(4)...
$$\tfrac{5}{8} \text{ of an acre} = 3025 \text{ square yards}$$

$$40\begin{cases} 5)3025 \\ \overline{8)605} \end{cases}$$

$$\text{length} = \overline{\ 75} \text{ yds. 1 ft. } 10\tfrac{1}{2} \text{ in.}$$

(5)...

| fur. | mi. |
|------|-----|

$\cdot3125 = 68\frac{3}{4}$ yds.          $\cdot1625 = 286$ yds.
   220                            1760
 $\overline{62500}$                       $\overline{97500}$
  6250                        11375
$\overline{68\cdot7500}$ yds.  ·           1625
                         $\overline{286\cdot0000}$ yds.

$$286 \text{ yds.} - 68\tfrac{3}{4} \text{ yds.} = 217\tfrac{1}{4} \text{ yds.}$$

$$\begin{array}{l} 4)\ 3 \\ \overline{40)23\cdot75} \\ \quad \overline{4)\ 1\cdot59375} \end{array}$$

1 ro. $23\frac{3}{4}$ per. = $\cdot3984375$ of an acre

(6)...

$$\cdot 66 \ \&c. = \frac{6}{9} = \frac{2}{3}; \quad \cdot 533 \ \&c. = \frac{53-5}{90} = \frac{48}{90} = \frac{8}{15};$$

$$\cdot 73232 \ \&c. = \frac{732-7}{990} = \frac{725}{990} = \frac{145}{198};$$

$$\cdot 27345345 \ \&c. = \frac{27345-27}{99900} = \frac{27318}{99900} = \frac{4553}{16650}$$

(7)...

```
13)9·0(·692307          21)17·0(·809523
   78                       168
   ———                      ———
   120                      200
   117                      189
   ———                      ———
    30                      110
    26                      105
    ———                     ———
    40                       50
    39                       42
    ———                     ———
   100                       80
 ·  91                       63
    ——                     · ——
     9                       17
```

(8)...     16 for a shilling = $\frac{3}{4}d$. each = 9d. per dozen

cost = $7\frac{1}{2}d$.   „

profit = $1\frac{1}{2}d$.   „

$$\overset{d.}{7\tfrac{1}{2}} \ : \ \overset{d.}{1\tfrac{1}{2}} \ :: \ 100 \ : \ 20 \text{ per cent. gain}$$

(9)...

```
          5
          — = ·714285714285(·845154 . . . .
          7
          64
     164) 742
          656
    1685) 8685
          8425
   16901) 26071
          16901
  169025) 917042
          845125
 1690304) 7191785
          6761216
          ———————
          430569
```

(10)... 

$$377933067(723$$
$$343$$

$7^2 \times 300 = 14700)\ \overline{34933}$

$\qquad \overline{29400} = 14700 \times 2$

$\qquad 840 = 7 \times 30 \times 2^2$

$\qquad 8 = 2^3$

$\qquad \overline{30248}$ subtrahend

$72^2 \times 300 = 1555200)\ \overline{4685067}$

$\qquad \overline{4665600} = 1555200 \times 3$

$\qquad 19440 = 72 \times 30 \times 3^2$

$\qquad 27 = 3^3$

$\qquad \overline{4685067}$

## EXERCISE CIII.

(1)...

$5^5 = 5 \times 5 \times 5 \times 5 \times 5 = 3125$

$6^6 = 6 \times 6 \times 6 \times 6 \times 6 \times 6 = 46656$

$7^7 = 7 \times 7 \times 7 \times 7 \times 7 \times 7 \times 7 = 823543$

$8^8 = 8 \times 8 \times 8 \times 8 \times 8 \times 8 \times 8 \times 8 = 16777216$

$9^9 = 9 \times 9 \times 9 \times 9 \times 9 \times 9 \times 9 \times 9 \times 9 = 387420489$

(2)...1.

|  | £ | s. | d. |
|---|---|---|---|
| $3s.\ 4d. = \frac{1}{6}$ of £1 | 2372 | 0 | 0 | =value at £1 per yd. |
| $\frac{1}{2}d. = \frac{1}{80}$ of $3s.\ 4d.$ | 395 | 6 | 8 |
| $\frac{1}{4}d. = \frac{1}{2}$ of $\frac{1}{2}d.$ | 4 | 18 | 10 |
|  | 2 | 9 | 5 |
|  | £402 | 14 | 11 |

2.

|  | £ | s. | d. |
|---|---|---|---|
| $5s.\ 0d. = \frac{1}{4}$ of £1 | 4263 | 0 | 0 | = value at £1 per oz. |
| $1s.\ 8d. = \frac{1}{3}$ of $5s.$ | 1065 | 15 | 0 |
| $2\frac{1}{2}d. = \frac{1}{8}$ of $1s.\ 8d.$ | 355 | 5 | 0 |
|  | 44 | 8 | $1\frac{1}{2}$ |
|  | £1465 | 8 | $1\frac{1}{2}$ |

3.

|  | £ | s. | d. |
|---|---|---|---|
| $2s.\ 6d. = \frac{1}{8}$ of £1 | 967 | 0 | 0 | =value at £1 per cwt. |
| $2\frac{1}{2}d. = \frac{1}{12}$ of $2s.\ 6d.$ | 120 | 17 | 6 |
|  | 10 | 1 | $5\frac{1}{2}$ |
|  | £1097 | 18 | $11\frac{1}{2}$ |

(3)...

$$\begin{array}{ccccccc} \text{hrs.} & \text{min.} & \text{mi.} & & \text{hr.} & & \text{mi.} \\ 4 & 32 & = 4\frac{8}{15} & : & 1 & :: & 17 & : & x \end{array}$$

$$x = \frac{15}{\underset{4}{\cancel{68}}} \times \frac{\cancel{17}}{1} = \frac{15}{4} \text{ mi.} = 3\frac{3}{4} \text{ miles}$$

(4)...10 acres 3 roods 39 perches 25$\frac{1}{4}$ sq. yds.=53235 sq. yds.

$$53235 \div 42\frac{1}{4} = 1260, \text{ No. of trees}$$

(5)...

$$\begin{array}{cc} \text{sq. ft.} & \text{ft.} \\ 446\frac{1}{3} \div 25\frac{3}{4} \end{array} = \frac{\overset{13}{\cancel{1339}}}{3} \times \frac{4}{\cancel{103}} = \frac{52}{3} = 17\frac{1}{3} \text{ feet}$$

(6)...

$$\begin{array}{ccccccc} \text{wo.} & \text{da.} & \text{hrs.} & & \text{wo. da. hrs.} & & s. & & s. \\ 5 \times 6 \times 10 & & & : & 6 \times 15 \times x & :: & 20 & : & 72 \end{array}$$

$$x = \frac{\cancel{5} \times \cancel{6} \times \cancel{10} \times \overset{\overset{12}{\cancel{24}}}{\cancel{72}}}{\underset{\underset{3}{\cancel{6}} \underset{2}{\times} \cancel{15} \times \cancel{20}}{}} = 12 \text{ hours}$$

(7)...    17·45 Eng. ells = 21·8125 yds. = 21$\frac{13}{16}$ yds.

$$\begin{array}{ccccccc} \text{yd.} & & \text{yds.} & & £ & & \\ 1 & : & 21\frac{13}{16} & :: & \frac{7}{30} & : & x \end{array}$$

$$x = \frac{349}{16} \times \frac{7}{30} = £\frac{2443}{480} = £5 \; 1s. \; 9\frac{1}{2}d.$$

(8)... 4 per cent. = $\frac{1}{25}$ of 100

$\frac{1}{2}$ „    „    = $\frac{1}{8}$ of 4

| | £ | s. | d. |
|---|---|---|---|
| | 647 | 10 | 0 |
| | 25 | 18 | 0 |
| | 3 | 4 | 9 |
| | 29 | 2 | 9 int. for 1 year |
| | | | 3$\frac{3}{4}$ |
| | 87 | 8 | 3 |
| $\frac{1}{2}$ year = | 14 | 11 | 4$\frac{1}{2}$ |
| $\frac{1}{4}$ year = | 7 | 5 | 8$\frac{1}{4}$ |
| | £109 | 5 | 3$\frac{3}{4}$ int. for 3$\frac{3}{4}$ years |

(9)... Int. for 1 year $= £74$ 16$s$. 3$d$.$+4\frac{1}{2} = £16$ 12$s$. 6$d$.

$$
\begin{array}{ccccccc}
£ & & £ & & £ & s. & d. \\
475 & : & 100 & :: & 16 & 12 & 6 \\
19 & & 4 & & & & 4 \\
\end{array}
$$

$$19)\overline{66\ 10\ \ 0}$$

$£3\ 10\ \ 0 = 3\frac{1}{2}$ per cent.

(10)...   Amount of £100 in $4\frac{3}{4}$ years at 5 per cent.

$= £100 + (£5 \times 4\frac{3}{4}) = £123$ 15$s$.

$$
\begin{array}{ccccc}
£\ \ s. & & £\ \ s.\ \ d. & & £ \\
123\ 15 & : & 276\ 19\ 10\frac{1}{2} & :: & 100 \\
20 & & 8 \times 10 = 80 & & 20 \\
\hline
2475 & & 2215\ 19\ \ 0 & & 2000 \\
99 & & 10 & & 80 \\
\end{array}
$$

$$99 \left\{ \begin{array}{l} 11)\overline{22159\ \ 10\ \ 0} \\ \ 9)\overline{2014\ \ 10\ \ 0} \end{array} \right.$$

$$£223\ \ 16\ \ 8$$

## EXERCISE CIV.

(1)...

|  |  |  | s. | d. | £ | s. | d. |
|---|---|---|---|---|---|---|---|
| $75\frac{1}{2}$ | yds. | Calico............... | 9$\frac{1}{2}$ | $= 2$ | 19 | 9$\frac{1}{4}$ |
| $52\frac{1}{2}$ | „ | Brown Holland... | 11$\frac{1}{2}$ | $= 2$ | 10 | 3$\frac{3}{4}$ |
| $78\frac{1}{2}$ | „ | Irish Linen ......1 | 8$\frac{1}{2}$ | $= 6$ | 14 | 1$\frac{1}{4}$ |
| 49 | „ | Welsh Flannel ...1 | 5$\frac{1}{2}$ | $= 3$ | 11 | 5$\frac{1}{4}$ |
| $26\frac{3}{4}$ | „ | Drugget  .........2 | 9 | $= 3$ | 13 | 6$\frac{3}{4}$ |

$£19\ \ 9\ \ 2\frac{1}{2}$

(2)...   2 qrs. 19$\frac{1}{2}$ lb. $\times 13 = 981\frac{1}{2}$ lb.

$$
\begin{array}{ccccccc}
\text{lb.} & & \text{lb.} & & £ & s. & d. \\
53\frac{1}{2} & : & 981\frac{1}{2} & :: & 1 & 8 & 11\frac{3}{4} & : & x \\
2 & & 2 & & & 20 & \\
\hline
107 & & 1963 & & & 28 & \\
& & & & & 12 & \\
& & & & & \hline \\
& & & & & 347 & \\
& & & & & 4 & \\
& & & & & \hline \\
& & & & & 1391 & \\
\end{array}
$$

$$x = \frac{1963 \times \overset{13}{1391}}{107} = 25519 \text{ far.} = £26\ 11s.\ 7\frac{3}{4}d.$$

$$\begin{array}{ccc} £ & s. & d. \end{array}$$

(3)...

$$\begin{array}{rrl}
1 & 14 & 8 \text{ per acre} \\
& & 4\times6\times10+8 = 248 \\ \hline
6 & 18 & 8 \\
& & 6 \\ \hline
41 & 12 & 0 \\
& & 10 \\ \hline
416 & 0 & 0 \\
13 & 17 & 4 \\
\end{array}$$

$$\begin{array}{llrr}
2\text{ ro.} & = \tfrac{1}{2}\text{ acre}\ldots\ldots = & 17 & 4 \\
10\text{ per.} & = \tfrac{1}{5}\text{ of }2\text{ ro.} = & 2 & 2 \\
5\text{ per.} & = \tfrac{1}{2}\text{ of }10\text{ per.} = & 1 & 1 \\
2\tfrac{1}{2}\text{ per.} & = \tfrac{1}{2}\text{ of }5\text{ per.} = & & 6\tfrac{1}{2} \\ \hline
& £430 & 18 & 5\tfrac{1}{2}
\end{array}$$

(4)...1. $\quad (3\tfrac{5}{7}+2\tfrac{5}{6}+3\tfrac{3}{10})-(2\tfrac{9}{14}+1\tfrac{7}{12}+2\tfrac{13}{20})$

$\quad = (3\tfrac{150}{210}+2\tfrac{175}{210}+3\tfrac{63}{210})-(2\tfrac{270}{420}+1\tfrac{245}{420}+2\tfrac{273}{420})$

$\quad = 9\tfrac{89}{105}-6\tfrac{92}{105}$

$\quad = 2\tfrac{102}{105} = 2\tfrac{34}{35}$

2. $\quad (4\tfrac{1}{2}\times6\tfrac{2}{3}\times3\tfrac{3}{8})\div(5\tfrac{2}{5}\times1\tfrac{2}{3}\times2\tfrac{2}{7})$

$$= \frac{9}{2}\times\frac{\overset{5}{\cancel{20}}}{\cancel{3}}\times\frac{\cancel{27}}{\underset{2}{\cancel{8}}}\times\frac{\cancel{5}}{\cancel{27}}\times\frac{\cancel{3}}{\cancel{5}}\times\frac{7}{16}$$

$\quad = \tfrac{315}{64} = 4\tfrac{59}{64}$

3. $\quad (7{\cdot}265-4{\cdot}937)\times(6{\cdot}58+9{\cdot}675)$

$\quad = 2{\cdot}328\times16{\cdot}255$

$\quad = 37{\cdot}84164$

(5)...

$$\frac{11}{18}\ \text{hf. gui.} = \frac{11}{\overset{}{\underset{6}{\cancel{18}}}} \times \frac{\overset{7}{\cancel{21}}}{2} = \frac{77}{12} = \overset{s.}{6}\ \overset{d.}{5}$$

$$\left(\frac{3}{5}\ \text{of}\ \frac{7}{12}\right)\ \text{hf. cr.} = \frac{7}{\overset{}{\underset{4}{\cancel{20}}}} \times \frac{\overset{}{\cancel{5}}}{2} = \frac{7}{8} = \frac{10\tfrac{1}{2}}{5\quad 6\tfrac{1}{2}}$$

$$\begin{array}{r} 4)\overline{2} \\ 12)\overline{6\cdot5} \\ 20)\overline{5\cdot5416} \\ 5s.\ 6\tfrac{1}{2}d. = \overline{\cdot277083}\ \text{of a sov.} \end{array}$$

(6)..." Discounting " a bill is giving cash for it, deducting a sum proportionate to the amount of the bill and the time it has to run. It is the invariable practice of bankers and bill-discounters to deduct *interest* instead of *discount*, thus charging for the transaction a sum exceeding the true discount by the interest upon the true discount for the given time. An illustration will make this clearer : If a bill for £410 be discounted at 5 per cent. when it has six months to run, the banker would deduct £10 5s. as *discount*, whereas the true discount is only £10. The difference, 5s., is the interest upon £10 for six months. The banker, in fact, has obtained interest on £410, whereas he has lent only £399 15s.: the latter sum, if put out to interest, would amount to £409 14s. 10½d. in six months, not to £410.

Amount of £100 in 4 months at 5 per cent. per annum
    = £100 + (£5 × ⅓) = £101 13s. 4d.

$$\begin{array}{ccccccccc} £ & s. & d. & & £ & & £ & s. & d. \\ 101 & 13 & 4 & : & 150 & :: & 1 & 13 & 4 & : & \text{required discount} \\ 3 & & & & & & 3 \\ \hline 305 & & & & & & 5 \end{array}$$

required discount $= \dfrac{150 \times \cancel{5}}{\underset{61}{\cancel{305}}} = £\dfrac{150}{61} = £2\ 9s.\ 2\tfrac{10}{61}d.$

Banker's discount, or interest $= £150 + 20 + 3$
$= £2 \ 10s. \ 0d.$
True discount $= £2 \quad 9s. \ 2\frac{10}{61}d.$
Amount of error $= \overline{\qquad 9\frac{51}{61}d.}$

This sum of $9\frac{51}{61}d.$ is the interest of $£2 \ 9s. \ 2\frac{10}{61}d.$ for 4 months, at 5 per cent. per annum.

(7)...    From March 17 to October 22 $= 219$ days
Int. on $£225 \ 12s. \ 6d.$ for 1 year $= £12 \ 15s. \ 7\frac{1}{2}d.$

$$
\begin{array}{ccccccc}
\text{da.} & & \text{da.} & & £ & s. & d. \\
365 & : & 219 & :: & 12 & 15 & 7\frac{1}{2} \\
5 & & 3 & & & & 3 \\
& & & & \overline{5)38} & 6 & 10\frac{1}{2} \\
& & & & £7 & 13 & 4\frac{1}{2}
\end{array}
$$

(8)...Amount of $£100$ in 9 months, at $4\frac{1}{2}$ per cent. per annum.
$= £100 + (£4 \ 10s. \times \frac{3}{4}) = £103 \ 7s. \ 6d.$

$$
\begin{array}{ccccccc}
£ & s. & d. & & £ & s. & & £ \\
103 & 7 & 6 & : & 157 & 10 & :: & 100 & : & \text{present worth} \\
& 8 & & & & 8 & & & & \\
\overline{827} & & & & \overline{1260} & & & &
\end{array}
$$

present worth $= \dfrac{1260 \times 100}{827} = £\dfrac{126000}{827} = £152 \ 7s. \ 1\frac{445}{827}d.$

(9)...
$$
\begin{array}{lll}
\text{A. 5 oxen} \times & 8 \text{ mo.} & = 40 \\
\text{B. 7 } \quad , \quad \times & 5 \quad , & = 35 \\
\text{C. 5 } \quad , \quad \times & 10 \quad , & = 50 \\
& & \overline{125}
\end{array}
$$

$$
\begin{array}{ccccccc}
& & & & £ & & £ \\
125 & : & 40 & :: & 25 & : & 8, \text{ A's portion} \\
& & & & £ & & £ \\
125 & : & 35 & :: & 25 & : & 7, \text{ B's portion} \\
& & & & £ & & £ \\
125 & : & 50 & :: & 25 & : & 10, \text{ C's portion}
\end{array}
$$

$$(10)\ldots \qquad \sqrt{7\tfrac{1}{9}} = \sqrt{\tfrac{64}{9}} = \tfrac{8}{3} = 2\tfrac{2}{3}$$

$$\sqrt[3]{166\tfrac{3}{8}} = \sqrt[3]{\tfrac{1331}{8}} = \tfrac{11}{2} = 5\tfrac{1}{2}$$

## EXERCISE CV.

(1)... See "*Answers.*"

(2)... See "*Answers.*"

(3)...

$$15 \begin{cases} 5)7 \\ \overline{3)1\cdot 4} \\ \hline \cdot 466 \ \&c. \end{cases} \qquad 16 \begin{cases} 4)11 \\ \overline{4)\ 2\cdot 75} \\ \hline \cdot 6875 \end{cases}$$

$$25 \begin{cases} 5)19 \\ \overline{5)\ 3\cdot 8} \\ \hline \cdot 76 \end{cases} \qquad 30 \begin{cases} 5)17 \\ \overline{6)\ 3\cdot 4} \\ \hline \cdot 566 \ \&c. \end{cases}$$

$$50 \begin{cases} 5)27 \\ \overline{10)\ 5\cdot 4} \\ \hline \cdot 54 \end{cases} \qquad 64 \begin{cases} 8)25 \\ \overline{8)\ 3\cdot 125} \\ \hline \cdot 390625 \end{cases}$$

(4)...

$$3\tfrac{1}{2} \ : \ 15\tfrac{3}{4} \ :: \ 1\tfrac{5}{8} \ : \ x$$

$$x = \frac{2}{7} \times \frac{\overset{9}{\cancel{63}}}{\underset{2}{\cancel{4}}} \times \frac{13}{8} = \frac{117}{16} = 7\tfrac{5}{16}$$

$$1\tfrac{2}{9} \ : \ x \ :: \ x \ : \ 2\tfrac{3}{4}$$

$$x^2 = 1\tfrac{2}{9} \times 2\tfrac{3}{4}$$
$$= \tfrac{11}{9} \times \tfrac{11}{4}$$
$$= \tfrac{121}{36}$$
$$\therefore \ x = \tfrac{11}{6} = 1\tfrac{5}{6}$$

(5)...

$$2 \text{ qrs. } 17\tfrac{1}{2} \text{ lb.} = 147 \text{ half-pounds}$$
$$1 \text{ cwt.} = 224 \qquad \text{,,}$$
$$\tfrac{147}{224} \div 7 = \tfrac{21}{32} \text{ of a cwt.}$$

R

(6)...   $\frac{19}{40} = \cdot475$        $\cdot725 = \frac{725}{1000} = \frac{29}{40}$

$\frac{19}{32} = \cdot59375$        $\cdot305 = \frac{305}{1000} = \frac{61}{200}$

$$\frac{19}{40} + \frac{29}{40} + \frac{19}{32} + \frac{61}{200} = \frac{380 + 580 + 475 + 244}{800}$$

$$= \frac{1679}{800} = 2\frac{79}{800}$$

$\cdot475$
$\cdot725$
$\cdot59375$
$\cdot305$
$\overline{2\cdot09875}$

(7)...

gui.
$\cdot6875 = 14s. \ 5\frac{1}{4}d.$
$\underline{21}$
$\overline{14\cdot4375s.}$
$\underline{12}$
$\overline{5\cdot2500d.}$
$\underline{4}$
$\overline{1\cdot0000 \text{ far.}}$

sov.
$\cdot8125 = 16s. \ 3d.$
$\underline{20}$
$\overline{16\cdot2500s.}$
$\underline{12}$
$\overline{3\cdot0000d.}$

$s. \quad d.$
$16 \quad 3$
$14 \quad 5\frac{1}{4}$
$\overline{1s. \ 9\frac{3}{4}d.}$

(8)...

$$\cdot4666 \ \&c. = \frac{46 - 4}{90} = \frac{42}{90} = \frac{7}{15}$$

$$\frac{7}{15} \text{ sov.} = \frac{7}{\overset{}{\underset{3}{\cancel{15}}}} \times \frac{\overset{4}{\cancel{20}}}{1} = \frac{\overset{s.}{28}}{3} = 9s. \ 4d.$$

(9)...

lb.          lb.          s.  d.          £
$3\frac{9}{10}$  :  $17\frac{7}{8}$  ::  $16 \ \ 3 = \frac{13}{16}$  :  $x$

$$x = \frac{\overset{5}{\cancel{10}}}{\underset{3}{\cancel{39}}} \times \frac{143}{\underset{4}{\cancel{8}}} \times \frac{\cancel{13}}{16} = £\frac{715}{192} = £3 \ 14s. \ 5\frac{3}{4}d.$$

(10)...        A can do $2\frac{2}{3}$ yards in 1 day
         B  „   $2\frac{2}{5}$   „      „

$\therefore$ A and B together can do $2\frac{2}{3}+2\frac{2}{5} = 5\frac{1}{15}$ yards in 1 day

$$114+5\frac{1}{15} = \frac{\overset{3}{\cancel{114}}}{1}\times\frac{15}{\underset{2}{\cancel{76}}} = \frac{45}{2} = 22\frac{1}{2} \text{ days}$$

### EXERCISE CVI.

(1)...

| ac. | ro. | po. | yds. |
|-----|-----|-----|------|
| 5 | 2 | 22 | $25\frac{1}{4}$ |
| 7 | 3 | 15 | $18\frac{1}{4}$ |
| 11 | 1 | 35 | $26\frac{1}{2}$ |
| 24 | 3 | 34 | $9\frac{1}{2}$ |

$$\begin{array}{r} 4 \\ \hline 99 \\ 40 \\ \hline 3994 \\ 30\frac{1}{4} \\ \hline 119829\frac{1}{2} \\ 998\frac{1}{2} \\ \hline 120828 \text{ square yards} \end{array}$$

(2)...1 cwt. 1 qr. $16\frac{1}{2}$ lb. $= 156\frac{1}{2}$ lb. £6 16s. $11\frac{1}{4}d.$ $= 6573$ far.

$$\begin{array}{ccccccc} \text{lb.} & & \text{lb.} & & \text{far.} & & \\ 156\frac{1}{2} & : & 1 & :: & 6573 & : & x \\ 2 & & 2 & & & & \\ \hline 313 & & 2 & & & & \end{array}$$

$$x = \frac{2\times\overset{21}{\cancel{6573}}}{\cancel{313}} = 42 \text{ far.} = 10\frac{1}{2}d. \text{ per lb.}$$

B 2

(3) ...

$$\begin{array}{r} \text{ft.} \\ 13800 \\ 4 \\ \hline 9\overline{)55200} \text{ sq. ft.} \\ 6133\tfrac{1}{3} \text{ sq. yds.} \\ 4 \end{array}$$

$$\begin{array}{l} \text{yds.} \qquad \text{qrs.} \\ 30\tfrac{1}{4} = 121 \left\{ \begin{array}{l} 11\overline{)245333\tfrac{1}{3}} \\ 11\overline{)\;\;2230\quad 3\tfrac{1}{3}} \\ 40\overline{)\;\;\;\;202\quad 8} \\ 4\overline{)\;\;\;\;\;\;5\quad 2} \text{ po.} \\ \qquad\quad 1\quad 1 \text{ ro.} \end{array} \right\} = 91\tfrac{1}{3} = \begin{array}{ccc} \text{qr. yds.} & \text{sq. yds.} & \text{sq. ft.} \\ 22 & 7\tfrac{1}{2} \end{array} \end{array}$$

*Ans.* 1 ac. 1 ro. 2 po. 22 sq. yds. 7½ sq. ft.

(4)...

$$\begin{array}{ccccccc} \text{yds.} & & \text{yds.} & & \pounds & s. & d. & & \pounds \\ 29\tfrac{5}{8} & : & 37\tfrac{3}{8} & : & 15 & 11 & 0\tfrac{3}{4} = 15\tfrac{177}{320} & : & x \end{array}$$

$$x = \frac{\cancel{8}}{\cancel{237}} \times \frac{299}{8} \times \frac{\overset{21}{\cancel{4977}}}{\underset{40}{\cancel{320}}} = \pounds\frac{6279}{320} = \pounds19 \; 12s. \; 5\tfrac{1}{4}d.$$

(5)...

• 

$$\begin{array}{l} 455725 \\ 192305 \\ \hline 263420 \text{ increase in 50 years} \end{array}$$

$$\begin{array}{ccccc} \cancel{192305} & : & 263420 & :: & \cancel{100} \\ 38461 & & 20 & & 20 \end{array}$$

$$38461\overline{)5268400}(136\tfrac{37704}{38461} \text{ per cent.}$$

$$\begin{array}{r} 38461 \\ \hline 142230 \\ 115383 \\ \hline 268470 \\ 220766 \\ \hline 37704 \\ 38461 \end{array}$$

(6)...
$$
\begin{array}{ccccccc}
\text{hrs.} & \text{da.} & & \text{hrs.} & \text{da.} & & \text{bu.} & \text{pk.} & & \\
15\times 6 & & : & 24\times 56 & & :: & 11 & 1 & : & x \\
& & & & & & & 4 & & \\
\hline
& & & & & & & 45 & &
\end{array}
$$

$$x = \frac{\overset{4}{\cancel{24}}\times 56 \times \overset{3}{\cancel{45}}}{\cancel{15}\times \cancel{6}} = 672 \text{ pecks} = 21 \text{ quarters}$$

(7)...

$$
\begin{array}{r}
\overset{\text{oz.}}{} \\
1\cdot 825 \quad : \quad 1\cdot 331 \quad :: \quad 4\cdot 5 \\
4\cdot 5 \\
\hline
6655 \\
5324 \\
\hline
\end{array}
$$

$$1\cdot 825)5\cdot 9895(3\cdot 2819 \text{ ounces}$$

$$
\begin{array}{r}
5475 \\
\hline
5145 \\
3650 \\
\hline
14950 \\
14600 \\
\hline
3500 \\
1825 \\
\hline
16750 \\
16425 \\
\hline
325
\end{array}
$$

(8)...     From May 13 to October 6 = 146 days

| per cent. | | £ | s. | d. |
|---|---|---|---|---|
| 5 | $\frac{1}{20}$ | 752 | 1 | 8 |
| $\frac{1}{4}$ | $\frac{1}{20}$ | 37 | 12 | 1 |
| | | 1 | 17 | $7\frac{1}{4}$ |

$$£39 \quad 9 \quad 8\frac{1}{4} \text{ int. for 1 year}$$

$$
\begin{array}{ccccccc}
\text{da.} & & \text{da.} & & & £ & \text{s.} & \text{d.} \\
\cancel{365} & : & \cancel{146} & :: & & 39 & 9 & 8\frac{1}{4} \\
5 & & 2 & & & & & 2
\end{array}
$$

$$
\begin{array}{r}
5)78 \quad 19 \quad 4\frac{1}{2} \\
\hline
£15 \quad 15 \quad 10\frac{1}{2}
\end{array}
$$

(9)..

|  | £ | s. | d. |
|---|---|---|---|
|  | 266 | 4 | 9 amount |
|  | 225 | 12 | 6 principal |
|  | £40 | 12 | 3 interest |

per cent.    £  s.  d.
$4 = \frac{1}{25}$)225 12 6
       £9  0  6 int. for 1 year

| £ | s. | d. |  | £ | s. | d. |  | yr. |  | yrs. |
|---|---|---|---|---|---|---|---|---|---|---|
| 9 | 0 | 6 | : | 40 | 12 | 3 | :: | 1 | : | $4\frac{1}{2}$ |

(10)...   $77\frac{1}{2}$  :  2500  ::  $3\frac{1}{2}$  :  required income
       2                   2
    $\overline{155}$               $\overline{7}$

$$\text{required income} = \frac{\overset{500}{\cancel{2500}} \times 7}{\underset{31}{\cancel{155}}} = £\frac{3500}{31} = £112\ 18s.\ 0\frac{24}{31}d.$$

## EXERCISE CVII.

(1)...

|  |  |  | s. | d. | £ | s. | d. |
|---|---|---|---|---|---|---|---|
| 15 doz. | Cotton Hose............ | 17 | 6 | = | 13 | 2 | 6 |
| 18 ,, | Angola ,, ............ | 27 | 6 | = | 24 | 15 | 0 |
| 10 ,, | Lbswool ,, ............ | 25 | 6 | = | 12 | 15 | 0 |
| 12 ,, | Cotton Half-hose...... | 13 | 6 | = | 8 | 2 | 0 |
| 9 ,, | Angola ,, ...... | 21 | 6 | = | 9 | 13 | 6 |
| 8 ,, | Kid Gloves ............ | 22 | 6 | = | 9 | 0 | 0 |
| 6 ,, | Norway Doe ditto. ... | 19 | 6 | = | 5 | 17 | 0 |
|  |  |  |  |  | £83 | 5 | 0 |

(2)...

$$\frac{11}{18}\text{ gui.} = \frac{11}{\cancel{18}_6}\times\frac{\cancel{21}^{7}}{1} = \frac{77}{6} = \quad \begin{matrix} s. & d. \\ 12 & 10 \end{matrix}$$

$$\frac{7}{15}\text{ sov.} = \frac{7}{\cancel{15}_3}\times\frac{\cancel{20}^{4}}{1} = \frac{28}{3} = \quad 9 \quad 4$$

$$\frac{11}{20}\text{ cr.} = \frac{11}{\cancel{20}_4}\times\frac{\cancel{5}}{1} = \frac{11}{4} = \quad 2 \quad 9$$

$$\frac{13}{16}\text{ fl.} = \frac{13}{\cancel{16}_8}\times\frac{\cancel{2}}{1} = \frac{13}{8} = \quad 1 \quad 7\tfrac{1}{2}$$

$$\underline{\phantom{xxx}} \quad \pounds1 \quad 6 \quad 6\tfrac{1}{2}$$

(3)...

| | |
|---|---|
| 4) 1 | 4) 1 |
| 12)11·25 | 12) 8·25 |
| 20)12·9375 | 21)19·6875 |
| 12s. 11¼d. = ·646875 of £1 | 19s. 8¼d. = ·9375 of a gui. |

(4)... $\dfrac{13}{112}\text{ week} = \dfrac{13}{\cancel{112}_{16}}\times\dfrac{\cancel{7}}{1} = \dfrac{13}{16}\text{ day} = 19\text{ hrs. }30\text{ min.}$

$$\begin{matrix} & \text{da.} \\ & ·90625 = 21\text{ hrs. }45\text{ min.} \\ & \underline{\phantom{xx}24} \\ & 362500 \\ & 181250 \\ & \overline{21·75000}\text{ hrs.} \\ & \underline{\phantom{xxx}60} \\ & \overline{45·00000}\text{ min.} \end{matrix}$$

$$\begin{matrix} \text{hrs.} & \text{min.} \\ 21 & 45 \\ 19 & 30 \\ \hline \text{hrs. }\quad 2 & 15\text{ min.} \end{matrix}$$

(5)...    $\cdot 174242 \ \&c. = \dfrac{1742-17}{9900} = \dfrac{1725}{9900} = \dfrac{23}{132},$

$\cdot 32957957 \ \&c. = \dfrac{32957-32}{99900} = \dfrac{32925}{99900} = \dfrac{439}{1332}$

(6)...
|hrs.|da.| |hrs.|da.| |ft.|ft.|ft.| |ft.|ft.|ft.|
|---|---|---|---|---|---|---|---|---|---|---|---|---|
|175|×12| : |300|×$x$| :: |20|×15|×14| : |28|×25|×18|

$$x = \frac{\cancel{175}^{7} \times \cancel{12} \times \cancel{28}^{2} \times \cancel{25}^{5} \times \cancel{18}^{\cancel{6}\,3}}{\cancel{300} \times \cancel{20} \times \cancel{15} \times \cancel{14}}_{\substack{\cancel{12}\ \ \cancel{4}\ \ \cancel{3} \\ \cancel{2}}} = 21 \text{ days}$$

(7)...Amount of £100 in 8 mo. at 4½ per cent. per annum
$$= £100 + (£4\tfrac{1}{2} \times \tfrac{2}{3}) = £103$$

| £ | | £ s. d. | | £ | | |
|---|---|---|---|---|---|---|
|103| : |113 17 6| : |100| : |present worth|
|8| |8| | | | |
|824| |911| | | | |

present worth $= \dfrac{911 \times \cancel{100}^{25}}{\cancel{824}_{206}} = £\dfrac{22775}{206} = £110 \ 11s. \ 1\tfrac{1+91\frac{1}{2}}{103}d.$

(8)...
| | | £ | | £ | | £ | | |
|---|---|---|---|---|---|---|---|---|
| | |89⅞| : |1000| :: |100| : |$x$|
| | |8| |8| | | | |
| | |719| |8000| | | | |

$$x = \frac{8000 \times 100}{719} = £\frac{800000}{719} = £1112 \ 13s. \ 1\tfrac{397}{719}d.$$

(9)...      68¾ lb. tea at 3s. 10d. per lb. = £13 3s. 6½d.
                              cost price = 11 9 2
                                 profit = £1 14 4½

£ s. d.         £ s. d.
11 9 2    :    1 14 4½  ::  100  :  15 per cent.


(10)...                          £ s. d.
                     A's debt = 265 10 0
                     B's  „   = 372 15 0
                     C's  „   = 438 12 6
                                £1076 17 6


£ s.           £ s. d.         s.
265 10   :   .179 4 3  ::  20  :  x
 20            20
5310          3584
              12
              43011


     81    2
x = $\frac{43011 \times 20}{5310}$ = 162d. = 13s. 6d. in the pound
      5310
      10


s. d.                        £ s. d.
10 0 = ½ of £1              |372 15 0
 2 6 = ¼ of 10s.            |186 7 6
 1 0 = 1/10 of 10s.         | 46 11 10½
                           | 18 12 9
        B's portion £251 12 1½


s. d.                        £ s. d.
10 0 = ½ of £1              |438 12 6
 2 6 = ¼ of 10s.           |219 6 3
 1 0 = 1/10 of 10s.        | 54 16 6¾
                           | 21 18 7½
        C's portion £296 1 5¼

## EXERCISE CVIII

(1)...

$16\begin{cases}4)\,11 \\ 4)\ \overline{2\cdot75}\end{cases}$   $\qquad$ $40\begin{cases}5)\,23 \\ 8)\ \overline{4\cdot6}\end{cases}$

$\qquad\qquad\overline{\cdot6875}$ $\qquad\qquad\qquad\qquad\overline{\cdot575}$

$18\begin{cases}2)\,13 \\ 9)\ \overline{6\cdot5}\end{cases}$   $\qquad$ $25\begin{cases}5)\,17 \\ 5)\ \overline{3\cdot4}\end{cases}$

$\qquad\qquad\overline{\cdot7\dot{2}}$ $\qquad\qquad\qquad\qquad\overline{\cdot68}$

$30\begin{cases}5)\,19 \\ 6)\ \overline{3\cdot8}\end{cases}$   $\qquad$ $48\begin{cases}8)\,25 \\ 6)\ \overline{3\cdot125}\end{cases}$

$\qquad\qquad\overline{\cdot6\dot{3}}$ $\qquad\qquad\qquad\qquad\overline{\cdot5208\dot{3}}$

(2)...   $\cdot275 = \frac{275}{1000} = \frac{11}{40}, \quad \cdot3125 = \frac{3125}{10000} = \frac{5}{16},$

$\cdot0625 = \frac{625}{10000} = \frac{1}{16}, \quad \cdot4875 = \frac{4875}{10000} = \frac{39}{80}$

(3)...   $\cdot755 = \frac{755}{1000} = \frac{151}{200}, \quad 9\cdot105 = 9\frac{105}{1000} = 9\frac{21}{200},$

$25\begin{cases}5)\,13 \\ 5)\ \overline{2\cdot6}\end{cases}$   $\qquad$ $32\begin{cases}4)\,19 \\ 8)\ \overline{4\cdot75}\end{cases}$

$\frac{13}{25} = \ \cdot52$ $\qquad\qquad\qquad \frac{19}{32} = \ \cdot59375$

$\frac{151}{200} + \frac{13}{25} + 9\frac{21}{200} + \frac{19}{32} = 9 + \dfrac{604 + 416 + 84 + 475}{800}$

$= 9 + \frac{1579}{800}$

$= 9 + 1\frac{779}{800} = 10\frac{779}{800}$

$\cdot755$
$\cdot52$
$9\cdot105$
$\cdot59375$
$\overline{10\cdot97375}$

(4)...  $27\frac{7}{8}$ = 27·875                         24·0125
              19·2375                $15\frac{13}{20}$ = 15·65
              ‾‾‾‾‾‾                              ‾‾‾‾‾‾‾
              8·6375 = $8\frac{51}{80}$            8·3625 = $8\frac{29}{80}$


(5)...    1.   19·425 − 26·05 + 57·0785 − 30·515 = 19·9385

          2.   (46·05 − 17·375 − 15·8625) × 8·57

          = 12·8125 × 8·57

          = 109·803125


(6)...           8·375                    ·5625
                 27·6                     ·1075
                 ‾‾‾‾‾                    ‾‾‾‾‾
                 50250                    28125
                 58625                    39375
                 16750                    56250
                 ‾‾‾‾‾‾                   ‾‾‾‾‾‾‾
                 231·1500                 ·06046875


(7)...  9·63)521·22375(54·125        76·35)·3550275(·00465
            4815                          30540
            ‾‾‾‾                          ‾‾‾‾‾
            3972                          49627
            3852                          45810
            ‾‾‾‾                          ‾‾‾‾‾
            1203                          38175
             963                          38175
            ‾‾‾‾                          ‾‾‾‾‾
            2407
            1926
            ‾‾‾‾
            4815
            4815


(8)...          357·436)29·3675000(·0821 . . . .
                         2859488
                         ‾‾‾‾‾‾‾
                          772620
                          714872
                          ‾‾‾‾‾‾
                          577480
                          357436
                          ‾‾‾‾‾‾
                          220044

(9)...

$$113\tfrac{47}{64} = 113{\cdot}734375$$
$$532{\cdot}048$$

$$\overline{909875000}$$
$$454937500$$
$$2274687500$$
$$341203125$$
$$568671875$$

$$\overline{60512{\cdot}146750000} = 60512\tfrac{587}{4000}$$

$$207\tfrac{53}{160} = 207{\cdot}33125$$
$$59{\cdot}436$$

$$\overline{124398750}$$
$$62199375$$
$$82932500$$
$$186598125$$
$$103665625$$

$$\overline{12322{\cdot}94017500} = 12322\tfrac{3767}{40000}$$    |

(10)...

$$505{\cdot}582 \div 471\tfrac{5}{8} = 505\tfrac{291}{500} \div 471\tfrac{5}{8}$$

$$= \frac{\overset{67}{\cancel{252791}}}{\underset{125}{\cancel{500}}} \times \frac{\overset{2}{\cancel{8}}}{\cancel{3773}}$$

$$= \tfrac{134}{125} = 1\tfrac{9}{125}$$

$$471\tfrac{5}{8} = 471{\cdot}625)505{\cdot}582000(1{\cdot}072$$
$$471625$$
$$\overline{3395700}$$
$$3301375$$
$$\overline{\phantom{00}943250}$$
$$\phantom{00}943250$$

$$764\tfrac{63}{250} = 764{\cdot}252)2426{\cdot}500100(3{\cdot}175$$
$$2292756$$
$$\overline{1337441}$$
$$764252$$
$$\overline{5731890}$$
$$5349764$$
$$\overline{\phantom{0}3821260}$$
$$\phantom{0}3821260$$

$$3{\cdot}175 = 3\tfrac{175}{1000} = 3\tfrac{7}{40}$$

## EXERCISE CIX.

(1)...

$$4)\ 3$$
$$12)\ \overline{3\cdot75}$$
$$20)\overline{13\cdot3125}$$

13s. 3¾d. = ‾‾‾·665625 of a sov.

$$4)1$$
$$12)\overline{2\cdot25}$$
$$21)\overline{9\cdot1875}$$

9s. 2¼d. = ·4375 of a gui.

(2)...

```
       sov.       s.  d.
    ·484375 = 9  8¼
       20
    9·687500s
       12
    8·250000d.
       4
    1·000000 far.
```

```
       gui.      s.  d.
    ·6875 = 14  5¼
       21
    14·4375s.
       12
    5·2500d,
       4
    1·0000 far.
```

```
          s.  d.
          9   8¼
         14   5¼
       £1  4  1½
```

(3)...

$$\frac{19}{28}\text{ gui.} = \frac{19}{\cancel{28}_{4}}\times\frac{\overset{3}{\cancel{21}}}{1} = \frac{57}{4} = 14^{s}\ 3^{d}$$

```
     sov.      s.  d.
   ·953125 = 19  0¾
      20
   19·062500s.
      12
   0·750000d.
      4
   3·000000 far.
```

```
      s.   d.
     19   0¾
     14   3
     4s.  9¾d.
```

(4)...

13s. 3¼d. =   637 farthings

£1 10s. 4d.  = 1456    „

$$\frac{637}{1456}+\frac{91}{91} = \frac{7}{16} = ·4375$$

(5)...
$$\begin{array}{r} 2)\ \underline{1} \\ 28)\overline{24\cdot5} \\ 4)\ \overline{3\cdot875} \end{array}$$

3 qrs. 24½ lb. = ·96875 of a cwt.

ton
$$\begin{array}{r} \cdot4875 = 9\text{ cwt. 3 qrs.} \\ 20 \\ \hline 9\cdot7500 \text{ cwt.} \\ 4 \\ \hline 3\cdot0000 \text{ qrs.} \end{array}$$


(6)...

fur.
$$\begin{array}{r} \cdot425 = 93\tfrac{1}{2}\text{ yds.} \\ 220 \\ \hline 93\cdot500 \text{ yds.} \end{array}$$

mile
$$\begin{array}{r} \cdot34375 = 605\text{ yds.} \\ 1760 \\ \hline 2062500 \\ 240625 \\ 34375 \\ \hline 605\cdot00000 \text{ yds.} \end{array}$$

605 yds.—93½ yds. = 511½ yards


(7)...
$$\begin{array}{r} 8)\ 1 \\ 30\tfrac{1}{4} = 30\cdot25)\overline{15\cdot125} \\ 40)\overline{25\cdot5} \\ 4)\ \overline{1\cdot6375} \end{array}$$

1 ro. 25 per. 15⅛ yds. = ·409375 of an acre


(8)...
$$\begin{array}{r} 4)2 \\ 2)\overline{1\cdot5} \\ 4)\overline{2\cdot75} \\ 8)\overline{5\cdot6875} \end{array}$$

5 bu. 2 pks. 1 gal. 2 qts. = ·7109375 of a quarter


(9)...

week
$$\begin{array}{r} \cdot59375 = 4\text{ days 3 hours 45 min.} \\ 7 \\ \hline 4\cdot15625 \text{ da.} \\ 24 \\ \hline 3\cdot75000 \text{ hrs.} \\ 60 \\ \hline 45\cdot000000 \text{ min.} \end{array}$$

$$\text{(10)}... \qquad \underset{\text{cwt.}}{·65625} \; : \; \underset{\text{cwt.}}{5·875} \; :: \; \underset{£}{2·75625} \; : \; ·x$$

$$x = \frac{\overset{1·175}{\cancel{5·875}} \times \overset{21}{\cancel{2·75625}}}{\underset{5}{\cancel{·65625}}} = £24·675 = £24 \; 13s. \; 6d.$$

*EXERCISE CX.*

(1)...
$$2s. \; 2\tfrac{1}{2}d. = 106 \text{ farthings}$$
$$£286 \; 15s. \; 0\tfrac{1}{2}d. = 275282 \text{ farthings}$$
$$275282 \div 106 = £2597$$

(2)...
$$19 \text{ miles} = 1203840 \text{ inches}$$
$$1203840 \div 28\tfrac{1}{2} = 42240 \text{ steps}$$

(3)... 1.

| s. d. | | £ s. d. | |
|---|---|---|---|
| 4 0 | $= \tfrac{1}{5}$ of £1 | 5347 0 0 | = value at £1 each |
| 6 | $= \tfrac{1}{8}$ of 4s. | 1069 8 0 | |
| 4 | $= \tfrac{1}{12}$ of 4s. | 133 13 6 | |
| $1\tfrac{1}{2}$ | $= \tfrac{1}{4}$ of 6d. | 89 2 4 | |
| | | 33 8 $4\tfrac{1}{2}$ | |
| | | £1325 12 $2\tfrac{1}{2}$ | |

. 2.

| | | £ s. d. | |
|---|---|---|---|
| 2 qrs. | $= \tfrac{1}{2}$ of 1 cwt. | 2 12 6 | per cwt. |
| | | | $3 \times 11 = 33$ |
| | | 7 17 6 | |
| | | 11 | |
| | | 86 12 6 | |
| 1 qr. | $= \tfrac{1}{2}$ of 2 qrs. | 1 6 8 | |
| 7 lb. | $= \tfrac{1}{4}$ of 1 qr. | 0 13 $1\tfrac{1}{2}$ | |
| $3\tfrac{1}{2}$ lb. | $= \tfrac{1}{2}$ of 7 lb. | 0 3 $3\tfrac{3}{4}$ | |
| | | 0 1 $7\tfrac{11}{16}$ | |
| | | £88 16 $9\tfrac{9}{16}$ | |

|  | £ | s. | d. |
|---|---|---|---|
| 3. | 3 | 17 | 10 per oz. |

$$4 \times 7 + 1 = 29$$

|  | 15 | 11 | 4 |
|---|---|---|---|
|  |  |  | 7 |

| dwts. grs. | | 108 | 19 | 4 |
|---|---|---|---|---|
| 10 0 = $\frac{1}{2}$ of 1 oz. |  | 3 | 17 | 10 |
| 2 12 = $\frac{1}{4}$ of 10 dwts. |  | 1 | 18 | 11 |
| 1  6 = $\frac{1}{2}$ of 2$\frac{1}{2}$ dwts. |  | 0 | 9 | 8$\frac{3}{4}$ |
|  |  | 0 | 4 | 10$\frac{3}{8}$ |
|  | £115 | 10 | 8$\frac{1}{8}$ |

|  | £ | s. | d. |
|---|---|---|---|
| (4)... | 10 | 15 | 0 |
|  |  |  | 12 |

|  | 129 | 0 | 0 value of 12 cows |
|---|---|---|---|
| cash | 47 | 12 | 6 |

$35 \begin{cases} 5)\overline{81\ \ 7\ \ 6} \text{ value of 35 sheep} \\ 7)\overline{16\ \ 5\ \ 6} \end{cases}$

|  | £2 | 6 | 6 value of 1 sheep |
|---|---|---|---|

|  | £ | s. | d. |
|---|---|---|---|
| (5)... | 52 | 10 | 0 per acre |
|  |  |  | 5 |

|  | 262 | 10 | 0 |
|---|---|---|---|
| 2 roods = | 26 | 5 | 0 |
| 1 rood  = | 13 | 2 | 6 |
| 20 perches = | 6 | 11 | 3 |
| 5  „  = | 1 | 12 | 9$\frac{3}{4}$ |
| 2  „  = | 0 | 13 | 1$\frac{1}{2}$ |
|  | £310 | 14 | 8$\frac{1}{4}$ value of A's field |

|  | £ | s. | d. |
|---|---|---|---|
|  | 65 | 0 | 0 per acre |
|  |  |  | 4 |

|  | 260 | 0 | 0 |
|---|---|---|---|
| 2 roods  = | 32 | 10 | 0 |
| 1 rood   = | 16 | 5 | 0 |
| 5 perches = | 2 | 0 | 7$\frac{1}{2}$ |
|  | £310 | 15 | 7$\frac{1}{2}$ value of B's field |
|  | 310 | 14 | 8$\frac{1}{4}$ |

B's field is worth     11$\frac{1}{4}$d. more than A's

$$\begin{array}{ccccc}\text{hor. da.} & & \text{hor. da.} & & \pounds \quad s. \quad d. \\ (6)\ldots \quad 7\times 5 & : & 13\times 63 & :: & 3 \quad 1 \quad 3 \quad : \quad x \end{array}$$

$$\begin{array}{c} 20 \\ \hline 61 \\ 12 \\ \hline 735 \end{array}$$

$$x = \frac{13\times \overset{9}{\cancel{63}}\times \overset{147}{\cancel{735}}}{\cancel{7}\times \cancel{5}} = 17199d. = \pounds 71\ 13s.\ 3d.$$

(7)... From April 29th to September 22nd = 146 days

$$5 \text{ per cent.} = \tfrac{1}{20})\overset{\pounds}{125}$$
$$\overline{\phantom{xx}\pounds 6 \quad 5s.}\ \text{interest for 1 year}$$

$$\begin{array}{ccccc}\text{da.} & & \text{da.} & & \pounds \quad s. \\ \cancel{365} & : & \cancel{146} & :: & 6 \quad 5 \\ 5 & & 2 & & 2 \end{array}$$
$$\overline{5)12\ 10}$$
$$\overline{\pounds 2\ 10s.}$$

$$\begin{array}{lr} & \pounds \quad s. \quad d. \\ (8)\ldots \qquad 76\tfrac{1}{2}\text{ lb. at } 4s.\ 6d.\text{ per lb.} = & 17 \quad 4 \quad 3 \\ \text{cost} = & 15 \quad 18 \quad 9 \\ \text{profit} = & \pounds 1 \quad 5 \quad 6 \end{array}$$

$$\begin{array}{ccccccc} \pounds \quad s. \quad d. & & \pounds \quad s. \quad d. & & & & \\ 15 \quad 18 \quad 9 & : & 1 \quad 5 \quad 6 & :: & 100 & : & 8 \text{ per cent.} \end{array}$$

$$\begin{array}{lll} & & \pounds \quad s. \quad d. \\ (9)\ldots \qquad 1 \text{ per cent.} = & \tfrac{1}{100}| & 848 \quad 6 \quad 8 \\ \tfrac{1}{8}\quad ,, \quad = & \tfrac{1}{8} & 8 \quad 9 \quad 8 \\ & & 1 \quad 1 \quad 2\tfrac{1}{2} \\ & & \overline{\pounds 9 \quad 10 \quad 10\tfrac{1}{2}} \end{array}$$

s

(10)...                           43046721(6561
                                  36
                          125) 704
                               625
                         1306) 7967
                               7836
                       13121) 13121
                              13121


                              387420489(729
                              343
        $7^2 \times 300 = 14700$) 44420
                              29400 = $14700 \times 2$
                                840 = $7 \times 30 \times 2^2$
                                  8 = $2^3$
                              30248 subtrahend
    $72^2 \times 300 = 1555200$)14172489
                         13996800 = $1555200 \times 9$
                           174960 = $72 \times 30 \times \times 9^2$
                              729 = $9^3$
                         14172489


### EXERCISE CXI.

(1)...        17    51
        $\dfrac{\cancel{187} \times \cancel{6120}}{\cancel{5280}} = \dfrac{867}{4} = 216\tfrac{3}{4}$ statute miles
              44
              4


(2)...                                  £    s.   d.
         $\cancel{3745}$  :  $\cancel{4815}$  ::  118   2    6
            7              9                         9
                                        7)1063  2    6
                                        £151 17    6

|            |        |       |                | s. | d. |   | £ | s. | d. |
|------------|--------|-------|----------------|----|----|---|---|----|----|
| (3)...     | 14½ yds. | Lutestring | .........| 3 | 9 | = | 2 | 14 | 4½ |
|            | 1¾ | „ | Satin .........  ..... | 4 | 3 | = |   | 7 | 5¼ |
|            | 5¼ | „ | Silk Velvet ...... | 8 | 6 | = | 2 | 6 | 9 |
|            | 7½ | „ | Cotton „  ...... | 1 | 9 | = |   | 13 | 1½ |
|            | 18 | „ | Calico ............ |   | 6¼ |   |   | 9 | 4½ |
|            | 7½ | „ | Ribbon ............ |   | 10½ | = |   | 6 | 6¾ |
|            | 3¾ | „ | Lace ................ | 2 | 6 | = |   | 9 | 4¼ |

$$£7 \quad 7 \quad 0$$

(4)...

$$17 \cdot 85)11 \cdot 15625(\cdot 625 \text{ of } £1 = 12s.\ 6d. \text{ per ton}$$
$$\underline{10710}$$
$$\overline{4462}$$
$$3570$$
$$\overline{8925}$$
$$8925$$

(5)...

|     |   |   | s. | d. |             |
|-----|---|---|----|----|-------------|
|     |   |   | 14 | 6  | per gallon  |
|     |   |   | $6 \times 6 + 1 = 37$ |    |             |

$$\overline{4 \quad 7 \quad 0}$$
$$6$$
$$\overline{26 \quad 2 \quad 0}$$
$$14 \quad 6$$

| | | | s. | d. |
|---|---|---|---|---|
| ⅓ gal. | = | | 7 | 3 |
| $\frac{1}{12}$ „ | = | | 1 | 2½ |

$$£27 \quad 4 \quad 11½$$

(6)...$19\frac{5}{8}$ yds. $\times 19 = 376\frac{5}{8}$ yds.     £7 11s. $4\frac{1}{2}d.$ = $£7\frac{91}{160}$

$$\underset{17\frac{3}{10}}{\overset{\text{yds.}}{}} \quad : \quad \underset{376\frac{5}{8}}{\overset{\text{yds.}}{}} \quad :: \quad \underset{7\frac{91}{160}}{\overset{£}{}} \quad : \quad x$$

$$x = \frac{\cancel{10}}{\cancel{173}} \times \frac{2261}{6} \times \frac{\cancel{1211}^{7}}{\cancel{160}_{16}} = £\frac{15827}{96} = £164 \ 17s. \ 3\frac{1}{2}d.$$

$$\begin{array}{ccc} \pounds & s. & d. \\ \end{array}$$

(7)...

$$\begin{array}{lll} 388 & 0 & 4\frac{1}{2} \text{ amount} \\ 343 & 0 & 0 \text{ principal} \\ \hline \pounds45 & 0 & 4\frac{1}{2} \text{ int. for } 3\frac{1}{2} \text{ years} \end{array}$$

$\pounds45$ 0s. $4\frac{1}{2}d. \div 3\frac{1}{2} = \pounds12$ 17s. 3d., int. for 1 year

$$\begin{array}{ccccccc} \pounds & & \pounds & & \pounds & s. & d. \\ 343 & : & 100 & :: & 12 & 17 & 3 & : & \pounds3\frac{3}{4} \text{ per cent.} \end{array}$$

(8)...Amount of $\pounds100$ in 8 months at $4\frac{1}{2}$ per cent. per annum
$= \pounds100 + (\pounds4\frac{1}{2} \times \frac{2}{3}) = \pounds103$

$$\begin{array}{cccccc} \pounds & & \pounds & s. & & \pounds \\ 103 & : & 190 & 10 & :: & 100 & : & \text{present worth} \\ & & 20 & & & \\ & & \overline{3810} & & & \end{array}$$

Present worth $= \dfrac{3810 \times 100}{103} = \dfrac{381000}{103}s. = \pounds184$ 19s. $0\frac{36}{103}d.$

(9)...

$$\begin{array}{r} 531677222244(729162 \\ 49 \\ \hline 142)\ 416 \\ 284 \\ \hline 1449)13277 \\ 13041 \\ \hline 14581)\ \ 23622 \\ 14581 \\ \hline 145826)\ 904122 \\ 874956 \\ \hline 1458322)\ 2916644 \\ 2916644 \\ \hline \end{array}$$

$$20346417(273$$
$$8$$
$$2^2 \times 300 = 1200)12346$$
$$\overline{8400} = 1200 \times 7$$
$$2940 = 2 \times 30 \times 7^2$$
$$343 = 7^3$$
$$\overline{11683} \text{ subtrahend}$$
$$27^2 \times 300 = 218700)663417$$
$$\overline{656100} = 218700 \times 3$$
$$7290 = 27 \times 30 \times 3^2$$
$$27 = 3^3$$
$$\overline{663417}$$

(10)... $\dfrac{4+\sqrt{12}}{4-\sqrt{12}} \times \dfrac{4+\sqrt{12}}{4+\sqrt{12}} = \dfrac{28+8\sqrt{12}}{16-12} = 7+2\sqrt{12}$

$$7+2 \cdot \overline{12} = 7+(2 \times 3.4641)$$
$$= 7+6.9282$$
$$= 13.9282$$

### EXERCISE CXII.

(1)...
$$\begin{array}{ccc} & £ & s. & d. \\ 924)5250 & 8 & 9(£5 \ 13s. \ 7\frac{3}{4}d. \\ 4620 \end{array}$$
$$\overline{630}$$
$$20$$
$$924)\overline{12608}(13s. \qquad\qquad 924 = 12 \times 11 \times 7$$
$$924$$
$$\overline{3368} \qquad\qquad\qquad \begin{array}{ccc} £ & s. & d. \\ 12)5250 & 8 & 9 \end{array}$$
$$2772 \qquad\qquad\qquad \overline{11)437 \ 10 \ 8\frac{3}{4}}$$
$$\overline{596} \qquad\qquad\qquad \overline{7)39 \ 15 \ 6\frac{1}{4}}$$
$$12 \qquad\qquad\qquad\qquad \overline{£5 \ 13 \ 7\frac{3}{4}}$$
$$924)\overline{7161}(7d.$$
$$6468$$
$$\overline{693}$$
$$4$$
$$924)\overline{2772}(3 \text{ far.}$$
$$2772$$
$$\overline{\phantom{2772}}$$

$$
\begin{array}{c c c}
\pounds & s. & d. \\
\end{array}
$$

(2)...
$$
\begin{array}{r}
\pounds \quad s. \quad d. \\
18)9\ \ 19\ \ 6 \\
\hline 11\ \ 1 \\
11 \\
\hline \pounds 6\ \ 1\ \ 11 \\
\end{array}
\qquad
\begin{array}{r}
\pounds \quad s. \quad d. \\
13)24\ \ 7\ \ 6 \\
\hline 1\ \ 17\ \ 6 \\
9 \\
\hline \pounds 16\ \ 17\ \ 6 \\
\end{array}
$$

£16 17s. 6d. − £6 1s. 11d. = £10 15s. 7d.

(3)...
$$
\begin{array}{r}
f. \\
4)1 \\
\hline 12)5\cdot25 \\
\hline 20)\ \ \cdot4375 \\
\hline 5\tfrac{1}{4}d. = \cdot021875\ \text{of a sov.}
\end{array}
\qquad
\begin{array}{r}
oz. \\
16)10 \\
\hline 28)\ \ 2\cdot625 \\
\hline 4)\ \ \cdot09375 \\
\hline 2\,\text{lb.}\,10\,\text{oz.} = \cdot0234375\ \text{of a cwt.}
\end{array}
$$

(4)...
$$
\begin{array}{r}
5\cdot013 \\
\cdot075 \\
\hline 25065 \\
35091 \\
\end{array}
$$

1·062) 375975000 (·354025......
$$
\begin{array}{r}
3186 \\
\hline 5737 \\
5310 \\
\hline 4275 \\
4248 \\
\hline 2700 \\
2124 \\
\hline 5760 \\
5310 \\
\hline 350 \\
\end{array}
$$

$$\frac{5\cdot013 \times \cdot075}{1\cdot062} = \cdot354025......$$

$$
\begin{array}{cccc}
\text{men} \ \ \text{da.} \ \ \text{ho.} & \text{men} \ \ \text{da.} \ \ \text{ho.} & \text{yds.} \ \ \text{yds.} & \text{yds.} \ \ \text{yds.}
\end{array}
$$

(5)...$5 \times 4\tfrac{1}{2} \times 12$ : $x \times 4\tfrac{1}{3} \times 13\tfrac{1}{2}$ :: $270 \times 240$ : $468 \times 180$

$$
\begin{array}{cccc}
6 & 2 & 6 & 2 \\
\hline 27 & 24 & 26 & 27
\end{array}
$$

$$x = \frac{5 \times 27 \times 24 \times 468 \times 180}{26 \times 27 \times 270 \times 240} = 6 \ \text{men}$$

$$
\begin{array}{lll}
 & \text{£} & \text{s.} & \text{d.} \\
\end{array}
$$

(6)...  4 per cent. $= \frac{1}{25}$ | 1075  16  8

$\frac{1}{4}$    ,,    $= \frac{1}{16}$ | 43  0  8

2  13  $9\frac{1}{6}$

45  14  $5\frac{1}{2}$ interest for 1 year

$3\frac{1}{2}$

137  3  $4\frac{1}{2}$

22  17  $2\frac{3}{4}$

£160  0  $7\frac{1}{4}$ interest for $3\frac{1}{2}$ years

(7)... Amount of £100 in 5 months at $4\frac{1}{2}$ per cent. per annum
$= £100 + (£4\frac{1}{2} \times \frac{5}{12}) = £101$ 17s. 6d.

$$
\begin{array}{ccc}
\text{£} \quad \text{s.} \quad \text{d.} & \text{£} \quad \text{s.} & \text{£} \\
101 \quad 17 \quad 6 \quad : & 287 \quad 10 \quad :: & 100 \quad : \quad x \\
8 & 8 & \\
\hline
815 & 2300 &
\end{array}
$$

$$
x = \frac{2300 \times \cancel{100}^{\,20}}{\cancel{815}_{\,163}} = £\frac{4600}{163} = £282 \; 4s. \; 2\tfrac{10}{163}d.
$$

(8)...

$$
\begin{array}{cccc}
100 & & & \\
20 & & \text{s.} \quad \text{d.} & \\
\overline{\cancel{120}} & : \times\cancel{100} :: & 3 \quad 6 & \\
6 & 5 & 5 & \\
& & \overline{6)17 \quad 6} &
\end{array}
$$

Cost price $= \quad 2s. \; 11d.$

(9)...  1 cwt. 1 qr. 25 lb. $=$ 165 lb.

$$
\begin{array}{lll}
& \text{£} & \text{s.} & \text{d.} \\
165 \text{ lb. at } 4\frac{1}{2} \text{ per lb.} = & 3 & 1 & 10\frac{1}{2} \\
\text{cost} = & 2 & 15 & 0 \\
\hline
\text{profit} = & & & 6s.10\frac{1}{2}d.
\end{array}
$$

$$
\begin{array}{cccc}
\text{£} \quad \text{s.} & \text{s.} \quad \text{d.} & & \\
2 \quad 15 \quad : & 6 \quad 10\frac{1}{2} \quad :: & 100 \quad : & 12\frac{1}{2} \text{ per cent.}
\end{array}
$$

$$
\begin{array}{llr}
 & d. & \pounds \quad s. \quad d. \\
(10)\ldots \quad 2450 \text{ yds. Calico } \ldots\ldots 7\tfrac{1}{2} = & 76 \ 11 \ \ 3 \\
\qquad\qquad 2325 \quad ,, \qquad ,, \quad \ldots\ldots 9 \ = & 87 \ \ 3 \ \ 9 \\
\qquad\qquad 2\tfrac{1}{2} \text{ per cent.} = \tfrac{1}{40} \overline{)163 \ 15 \ \ 0} \\
\qquad\qquad\qquad\qquad\qquad \pounds 4 \ \ 1 \ 10\tfrac{1}{2}
\end{array}
$$

## EXERCISE CXIII.

$$
\begin{array}{llr}
 & s. \ d. & \pounds \quad s. \quad d. \\
(1)\ldots \quad 14\tfrac{1}{2} \text{ lb. Tea } \ldots\ldots 3 \ 8 \ = & 2 \ 13 \ \ 2 \\
\qquad\quad 10\tfrac{1}{2} \ ,, \ \text{ Coffee } \ldots 1 \ 6 \ = & 0 \ 15 \ \ 9 \\
\qquad\quad 25 \quad ,, \ \text{ Sugar } \ldots 0 \ 5\tfrac{1}{2} = & 0 \ 11 \ \ 5\tfrac{1}{2} \\
\qquad\qquad\qquad\qquad\qquad \pounds 4 \ \ 0 \ \ 4\tfrac{1}{2}
\end{array}
$$

$$
\begin{array}{llr}
 & s. \ d. & \pounds \quad s. \quad d. \\
27\tfrac{1}{2} \text{ yds. Linen Sheeting } \ldots\ldots 1 \ 8 \ = & 2 \ \ 5 \ 10 \\
13 \quad ,, \quad \text{ Flannel } \ldots\ldots\ldots\ldots 1 \ 6 \ = & 0 \ 19 \ \ 6 \\
19 \quad ,, \quad \text{ Calico} \ldots\ldots\ldots\ldots\ldots 0 \ 9\tfrac{1}{2} = & 0 \ 15 \ \ 0\tfrac{1}{2} \\
\qquad\qquad\qquad\qquad\qquad \pounds 4 \ \ 0 \ \ 4\tfrac{1}{2}
\end{array}
$$

The debts are equal

$$
\begin{array}{ll}
(2)\ldots & \pounds \quad s. \quad d. \\
 & 1 \ 15 \ \ 0 \text{ per acre} \\
 & 8 \times 8 \times 4 + 1 = 257 \\
 & \overline{14 \ \ 0 \ \ 0} \\
 & \qquad\quad 8 \\
 & \overline{112 \ \ 0 \ \ 0} \\
 & \qquad\quad 4 \\
\end{array}
$$

$$
\begin{array}{lrr}
 & 448 \ \ 0 \ \ 0 \\
1 \text{ rood} = \tfrac{1}{4} \text{ of } 1 \text{ ac.} & 1 \ 15 \ \ 0 \\
20 \text{ per.} = \tfrac{1}{2} \text{ of } 1 \text{ rood} & 0 \ \ 8 \ \ 9 \\
10 \quad ,, \quad = \tfrac{1}{2} \text{ of } 20 \text{ per.} & 0 \ \ 4 \ \ 4\tfrac{1}{2} \\
 & 0 \ \ 2 \ \ 2\tfrac{1}{4} \\
 & \overline{\pounds 450 \ 10 \ \ 3\tfrac{3}{4}}
\end{array}
$$

$$
(3)\ldots \qquad 3\tfrac{8}{9} \text{ inches} = \dfrac{\overset{7}{\cancel{35}}}{9} \times \dfrac{1}{\underset{9}{\cancel{45}}} = \dfrac{7}{81} \text{ of an English ell}
$$

$$
\dfrac{5}{27} \text{ E. ell} = \dfrac{5}{27} \text{ of } 3\tfrac{3}{4} \text{ ft.} = \dfrac{5}{\underset{9}{\cancel{27}}} \times \dfrac{\overset{5}{\cancel{15}}}{4} = \dfrac{25}{36} \text{ of a foot}
$$

(4)...·671875 = 13 cwt. 1 qr. 21 lb.

$$\underline{\phantom{0}20\phantom{000}}$$
$$\overline{13\cdot437500}\text{ cwt.}$$
$$\underline{\phantom{00}4\phantom{0000}}$$
$$\overline{1\cdot750000}\text{ qr.} \qquad \frac{29}{32}\text{ cwt.} = \frac{29}{\cancel{32}}\times\frac{\cancel{4}}{1} = \frac{29}{8}\text{ qr.} = 3\text{ qrs. }17\tfrac{1}{2}\text{ lb.}$$
$$\underline{\phantom{00}28\phantom{000}}$$
$$\overline{21\cdot000000}\text{ lb.}$$

$$\begin{array}{ccc} \text{cwt.} & \text{qrs.} & \text{lb.} \\ 13 & 1 & 21 \\ & 3 & 17\tfrac{1}{2} \\ \hline \text{cwt. } 14 & 1 & 10\tfrac{1}{2}\text{ lb.} \end{array}$$

(5)...

$$\cdot71818\ \&c. = \frac{718-7}{990} = \frac{711}{990} = \frac{79}{110}$$

$$\cdot20756756\ \&c. = \frac{20756-20}{99900} = \frac{20736}{99900} = \frac{192}{925}$$

(6)...
$$\begin{array}{cccccc} \text{cwt.} & \text{qr.} & \text{lb.} & \text{mi.} & \text{cwt.} & \text{qrs.} \\ 2 & 1 & 20\times52\tfrac{1}{2} & : & 1 & 3 \\ 4 & & 2 & & 4 \\ \hline 9 & & \overline{105} & & \overline{7} \\ 28 & & & & 28 \\ \hline 272 & & & & \overline{208} \end{array}$$

$$\begin{array}{ccc} \text{lb.} & \text{mi.} & \text{s.} \quad \text{d.} \\ 12\times7\times97\tfrac{1}{2} & :: & 9 \quad 11 \quad : \quad \text{\textit{x}} \\ 2 & & 12 \\ \hline \overline{195} & & \overline{119} \end{array}$$

$$x = \frac{\overset{13}{\cancel{208}}\times7\times\overset{13}{\cancel{195}}\times\overset{7}{\cancel{119}}}{\underset{17}{\cancel{272}}\times\underset{15}{\cancel{105}}} = 1183d. = \text{£}4\ 18s.\ 7d.$$

(7)... £116 17s. 6d.÷2¾ = £42 10s. interest for 1 year

$$\begin{array}{ccccccc} \text{£} & & \text{£} & & \text{£} \quad s. & & \text{£} \quad s. \\ 1000 & : & 100 & :: & 42 \quad 10 & : & 4 \quad 5 = 4\tfrac{1}{4}\text{ per cent.} \end{array}$$

(8)...

$$\begin{array}{l} \qquad\qquad\qquad \text{£} \quad s. \quad d. \\ \qquad\qquad 100)1575 \quad 0 \quad 0 \\ 2s.\ 6d. = \tfrac{1}{8}\text{ of £1} \ \overline{\ 15\ 15\ \ 0\ }\text{ amount at £1 per cent.} \\ 1s.\ 0d. = \tfrac{1}{20}\text{ of £1} \ \phantom{|}\ 1\ 19\ \ 4\tfrac{1}{2} \\ \qquad\qquad\qquad\qquad\quad 15\ \ .9 \\ \qquad\qquad\qquad\quad \overline{\text{£}2\ 15\ \ 1\tfrac{1}{2}}\text{ amount at 3}s.\ 6d.\text{ per cent.} \end{array}$$

(9)...
$$
\begin{array}{ll}
s. & d. \\
2 & 6\times25\times52 = 162\ 10 \\
3 & 6\times17\times52 = 154\ 14 \\
4 & 0\times\ 7\times52 = \ \ 72\ 16
\end{array}
$$
$$
5\text{ per cent.} = \tfrac{1}{20})\overline{390\ \ 0}
$$
commission £19 10s.

(10)...
$$
\frac{1}{5}+\left(\frac{\cancel{5}}{\underset{6}{\cancel{24}}}\text{ of }\frac{\cancel{4}}{5}\right)=\frac{1}{5}+\frac{1}{6}=\frac{6+5}{30}=\frac{11}{30}
$$

$$
1-\tfrac{11}{30}=\tfrac{19}{30}
$$

$$
\tfrac{19}{30}\ :\ 1\ ::\ \overset{£}{2850}\ :\ x
$$

$$
x=\frac{30}{\cancel{19}}\times\frac{\overset{150}{\cancel{2850}}}{1}=£4500
$$

## EXERCISE CXIV.

(1)...1.
$$
\frac{3\tfrac{7}{25}-1\dot{0}1\dot{6}}{2\cdot7\dot{6}+5\tfrac{5}{12}}=\frac{3\tfrac{7}{25}-1\tfrac{2}{125}}{2\tfrac{12}{25}+5\tfrac{5}{12}}=\frac{3\tfrac{35}{125}-1\tfrac{2}{125}}{2\tfrac{228}{300}+5\tfrac{125}{300}}=\frac{2\tfrac{33}{125}}{8\tfrac{53}{300}}
$$

$$
=\frac{\tfrac{283}{125}}{\tfrac{2453}{300}}=\frac{283\times\overset{12}{\cancel{300}}}{2453\times\underset{5}{\cancel{125}}}=\frac{3396}{12265}
$$

2.
$$
\frac{\tfrac{3}{5}(4\tfrac{1}{3}+3\tfrac{1}{4})}{\tfrac{2}{7}(8\tfrac{1}{5}-5\tfrac{1}{6})}=\frac{\tfrac{3}{5}(4\tfrac{4}{12}+3\tfrac{3}{12})}{\tfrac{2}{7}(8\tfrac{6}{30}-5\tfrac{5}{30})}=\frac{\tfrac{3}{5}\text{ of }7\tfrac{7}{12}}{\tfrac{2}{7}\text{ of }3\tfrac{1}{30}}=\frac{\tfrac{91}{20}}{\tfrac{13}{15}}
$$

$$
=\frac{\overset{7}{\cancel{91}}\times\overset{3}{\cancel{15}}}{\cancel{13}\times\underset{4}{\cancel{20}}}=\frac{21}{4}=5\tfrac{1}{4}
$$

(2)...
$$
\frac{7}{8\tfrac{1}{5}}\times11\tfrac{1}{9}\times\frac{3\tfrac{5}{6}}{5}\times5\tfrac{6}{7}\times3\tfrac{3}{11}\times\frac{7\tfrac{1}{3}}{5\tfrac{3}{4}}\times1\tfrac{11}{25}\times\frac{\tfrac{9}{11}}{8\tfrac{8}{11}}
$$

$$
=\frac{\cancel{35}}{\cancel{41}}\times\frac{\overset{4}{\cancel{100}}}{9}\times\frac{23}{\underset{6}{\cancel{30}}}\times\frac{41}{7}\times\frac{\overset{4}{\cancel{36}}}{11}\times\frac{\overset{8}{\cancel{88}}}{\underset{3}{\cancel{69}}}\times\frac{\overset{6}{\cancel{36}}}{25}\times\frac{\cancel{9}}{\underset{4}{\cancel{32}}}=24
$$

(3)...

$$\begin{array}{r} \text{min.} \\ 60)\overline{18} \\ \hline 24)\ \overline{6\cdot3} \\ \hline 7)\ \overline{\cdot2625} \\ \hline \end{array}$$

6 hrs. 18 min. = ·0375 of a week

(4)...

$$\begin{array}{ccc} \pounds & s. & d. \\ 1 & 16 & 9 \text{ per cwt.} \\ & & 6\times7+1 = 43 \\ \hline 11 & 0 & 6 \\ & & 7 \\ \hline \end{array}$$

|  | | £ | s. | d. |
|---|---|---|---|---|
|  | | 77 | 3 | 6 |
| 2 qrs. = $\frac{1}{2}$ of 1 cwt. | | 1 | 16 | 9 |
| 1 qr. = $\frac{1}{2}$ of 2 qrs. | | 0 | 18 | $4\frac{1}{2}$ |
| 16 lb. = $\frac{1}{7}$ of 1 cwt. | | 0 | 9 | $2\frac{1}{4}$ |
| 8 lb. = $\frac{1}{2}$ of 16 lb. | | 0 | 5 | 3 |
|  | | 0 | 2 | $7\frac{1}{2}$ |

$$\pounds80 \quad 15 \quad 8\frac{1}{4}$$

(5)...

$$\frac{17}{28}\text{ gui.} = \frac{17}{\cancel{28}}\times\frac{\cancel{21}}{1} = \frac{51}{4}s. = 12s.\ 9d.$$

$$\frac{33}{40}\text{ cr.} = \frac{33}{\cancel{40}}\times\frac{\cancel{5}}{1} = \frac{33}{8}s. = 4s.\ 1\frac{1}{2}d.$$

sov.
·453125 = 9s. $0\frac{3}{4}d.$
$\quad\quad 20$
9·062500s.
$\quad\quad 12$
0·750000d.
$\quad\quad 4$
3·000000 far.

fl.
·34375 = $8\frac{1}{4}d.$
$\quad\quad 2$
·68750s.
$\quad\quad 12$
8·25000d.
$\quad\quad 4$
1·00000 far.

$$\begin{array}{cc} s. & d. \\ 12 & 9 \\ 9 & 0\frac{3}{4} \\ 4 & 1\frac{1}{2} \\ & 8\frac{1}{4} \\ \hline \pounds1\quad 6 & 7\frac{1}{2} \\ \end{array}$$

$$
\begin{array}{cccccc}
& \text{per. we.} & & \text{per. we.} & & \pounds \quad s. \\
(6)\ldots & 5\times4 & : & 9\times13 & :: & 15 \quad 15 \quad : \quad x \\
& & & & & \underline{20} \\
& & & & & 315
\end{array}
$$

$$
x = \frac{9\times13\times\overset{63}{\cancel{315}}}{\cancel{5}\times\cancel{4}} = \frac{7371}{4}s. = \pounds 92 \ 2s. \ 9d.
$$

$$
\begin{array}{cl}
& \quad\quad\quad \text{men} \quad \text{wks.} \\
(7)\ldots & \text{A} \quad 160\times7 = 1120 \\
& \text{B} \quad 220\times9 = \underline{1980} \\
& \quad\quad\quad\quad\quad\quad 3100
\end{array}
$$

$$
\begin{array}{ccccccc}
& & & & \pounds & & \pounds \\
3100 & : & 1120 & :: & 3875 & : & 1400 \quad \text{A's share} \\
3100 & : & 1980 & :: & 3875 & : & 2475 \quad \text{B's share}
\end{array}
$$

$$
\begin{array}{clcl}
& \pounds & \pounds & \pounds \quad s. \quad d. \\
(8)\ldots & \cancel{100} \ : & \cancel{1625} \ :: & 81 \quad 7 \quad 6 \\
& 4 & 65 & \quad\quad\quad\quad 5\times13 = 65 \\
& & & \overline{406 \ 17 \ .6} \\
& & & \quad\quad 13 \\
& & & 4)\overline{5289 \quad 7 \quad 6} \\
& & & \pounds1322 \quad 6 \ 10\tfrac{1}{2}
\end{array}
$$

$$
\begin{array}{crcl}
& & & \pounds \quad s. \quad d. \\
(9)\ldots & 75 \text{ lb. Tea at } 4s.\ 3d. \text{ per lb.} & = & 15 \quad 18 \quad 9 \\
& \text{cost} & = & 14 \quad 1 \quad 3 \\
& \text{profit} & = & \pounds1 \quad 17 \quad 6
\end{array}
$$

$$
\begin{array}{cccccc}
\pounds \ s. \ d. & & \pounds \ s. \ d. & & & \\
14 \ 1 \ 3 & : & 1 \ 17 \ 6 & :: & 100 & : & 13\tfrac{1}{3} \text{ per cent.}
\end{array}
$$

(10)...  $\quad$ 61013446081(247009

```
            61013446081(247009
            4
        44)210                          247009(497
           176                          16
        487) 3413                      89) 870
             3409                          801
      494009)    4446081              987) 6909
                 4446081                   6909
```

$$
\therefore \ \sqrt[4]{61013446081} = 497
$$

## EXERCISE CXV.

(1)...

$$(4\tfrac{3}{8})^2 \times (6\tfrac{2}{5})^3 = \overset{7}{\frac{\cancel{35}}{\cancel{8}}} \times \overset{7}{\frac{\cancel{35}}{\cancel{8}}} \times \overset{4}{\frac{\cancel{32}}{\cancel{5}}} \times \overset{4}{\frac{\cancel{32}}{\cancel{5}}} \times \frac{32}{5} = \frac{25088}{5} = 5017\tfrac{3}{5}$$

(2)...

$$.26351351 \ \&c. = \frac{26351-26}{99900} = \frac{26325}{99900} = \frac{39}{148}$$

$$.734774774 \ \&c. = \frac{734774-734}{999000} = \frac{734040}{999000} = \frac{2039}{2775}$$

(3)...

```
                              s.  d.
               1.             11   8  per yard
                                5 × 9 + 2 = 47
                            ----------
                             2 18   4
                                    9
                            ----------
                            26   5   0
                             1   3   4
   ½ yd. or  8/16 yd. =  0   5  10
   ⅛ yd. or  2/16 yd. =  0   1   5½
              1/16 yd. =  0   0   8¾
                            ----------
                           £27  16   4¼
```

```
                                     £   s.  d.
   2.     2 qrs. = ½ of 1 cwt. |      3   5   4  per cwt.
                               |             13
                               |     ----------
                               |     42   9   4
   14  lb. = ¼ of 2 qrs.       |      1  12   8
    7  lb. = ½ of 14 lb.       |      0   8   2
   1¾  lb. = ¼ of  7 lb.       |      0   4   1
                               |      0   1   0½
                               |     ----------
                               |    £44  15   3¼
```

$$
\begin{array}{ccc}
& £ & s. & d \\
3. & 45 & 0 & 0 \\
\end{array}
$$

$$4 \times 4 + 3 = 19$$

$$
\begin{array}{ccc}
\overline{180} & 0 & 0 \\
 & & 4 \\
\hline
720 & 0 & 0
\end{array}
$$

3 ro. $= \frac{1}{4}$ of 3 acres    135  0  0
30 per. $= \frac{1}{4}$ of 3 roods   33 15  0
$3\frac{3}{4}$ per. $= \frac{1}{8}$ of 30 per.    8  8  9
                                    1  1  1$\frac{1}{8}$
$$\overline{£898 \quad 4 \quad 10\frac{1}{8}}$$

(4)...
$$
\begin{array}{ccccccc}
\text{cop.} & \text{pa.} & & \text{cop.} & \text{pa.} & & \text{re.} \\
1200 \times 32 & : & 1500 \times 272 & :: & 5 & : & x
\end{array}
$$

$$x = \frac{\overset{5}{\cancel{1500}} \times \overset{17}{\cancel{272}} \times 5}{\underset{4}{\cancel{1200}} \times \underset{2}{\cancel{32}}} = \frac{425}{8} = 53\frac{1}{8} \text{ reams}$$

(5)...
Let 6 = wife's share
then 3 = each son's share
and 2 = each daughter's share

$$6 + (3 \times 3) + (2 \times 4) = 23 = £23000$$

$$
\begin{array}{ccccccc}
& & & £ & & £ \\
23 & : & 6 & :: & 23000 & : & 6000, \text{ wife's share} \\
23 & : & 3 & :: & 23000 & : & 3000, \text{ each son's share} \\
23 & : & 2 & :: & 23000 & : & 2000, \text{ each daughter's share}
\end{array}
$$

(6)...
$2\frac{1}{2}$ per cent. $= \frac{1}{40}$    £ s. d.
                                     131  5  0 = 125 guineas
$1\frac{1}{4}$ ,, ,, $= \frac{1}{2}$    3  5  7$\frac{1}{2}$
                                     1 12  9$\frac{3}{4}$
$$\overline{£4 \quad 18 \quad 5\frac{1}{4}} \text{ interest for 1 year}$$

$$
\begin{array}{ccccccc}
\text{da.} & & \text{yrs. da.} & & \text{da.} & & £ \; s. \; d. \\
\cancel{365} & : & 2 \; 219 & = & \cancel{949} & :: & 4 \; 18 \; 5\frac{1}{4} \\
5 & & & & 13 & & 13
\end{array}
$$

$$5)\overline{63 \; 19 \; 8\frac{1}{4}}$$
$$\overline{£12 \; 15 \; 11\frac{1}{4}}$$

(7)...
```
      100        100
        8         20          s.  d.
      ̶1̶0̶8̶   :   ̶1̶2̶0̶  ::  11   3
        9         10              10
                      ∴  9)5  12   6
                         ‾‾‾‾‾‾‾‾‾‾‾
                         12s. 6d. per yard
```

(8)...
$$\sqrt{1395\tfrac{100}{196}} = \sqrt{\tfrac{273529}{196}} = \tfrac{523}{14} = 37\tfrac{5}{14}$$

$$\sqrt{2780\tfrac{181}{225}} = \sqrt{\tfrac{625681}{225}} = \tfrac{791}{15} = 52\tfrac{11}{15}$$

(9)...
```
                      286191179(659
                      216
6² × 300 = 10800)70191
            ‾‾‾‾‾‾‾‾‾‾‾
            54000 = 10800 × 5
             4500 = 6 × 30 × 5²
              125 = 5³
            ‾‾‾‾‾‾‾‾‾‾‾
            58625 subtrahend
65² × 300 = 1267500)11566179
            ‾‾‾‾‾‾‾‾‾‾‾‾‾
         11407500 = 1267500 × 9
           157950 = 65 × 30 × 9²
              729 = 9³
            ‾‾‾‾‾‾‾‾‾‾‾‾‾
         11566179
```

(10)...
$$\frac{8+\sqrt{14}}{8-\sqrt{14}} \times \frac{8+\sqrt{14}}{8+\sqrt{14}} = \frac{78+16\sqrt{14}}{50}$$

$$= 1\cdot56 + (\tfrac{8}{25} \text{ of } 3\cdot7416)$$

$$= 1\cdot56 + 1\cdot1973$$

$$= 2\cdot7573 \ldots$$

Or thus,

$$\frac{8+\sqrt{14}}{8-\sqrt{14}} = \frac{8+3\cdot74165}{8-3\cdot74165} = \frac{11\cdot74165}{4\cdot25835}$$

$$= 2\cdot7573 \ldots$$

## EXERCISE CXVI.

(1)...

| E. deg. | | E. deg. | | F. deg. |
|---|---|---|---|---|
| 9̸0̸ | : | 137·52 | :: | 1̸0̸0̸ |
| 9 | | 10 | | 10 |

$$9\overline{)1375\cdot2}$$

152·8 F. degrees

(2)...

| cwt. mi. | | mi. | | s. d. | | s. d. |
|---|---|---|---|---|---|---|
| 2½ × 125 | : | $x$ × 87½ | :: | 8  4 | : | 7  7 |
| 4   2 | | 2 | | 12 | | 12 |
| $\overline{10}$  $\overline{250}$ | | $\overline{175}$ | | $\overline{100}$ | | $\overline{91}$ |

$$x = \frac{1\!\!\!/0 \times 25\!\!\!/0 \times 9\!\!\!/1}{17\!\!\!/5 \times 1\!\!\!/0\!\!\!/0} = 13 \text{ qrs.} = 3\tfrac{1}{4} \text{ cwt.}$$

(3)...

| ho. da. | | ho. | | bu. pks. | | bu. pks |
|---|---|---|---|---|---|---|
| 5 × 9 | : | 17 × $x$ | :: | 8  1¾ | : | 66  3¾ |
| | | | | 4 | | 4 |
| | | | | $\overline{33}$ | | $\overline{267}$ |
| | | | | 4 | | 4 |
| | | | | $\overline{135}$ | | $\overline{1071}$ |

$$x = \frac{5\!\!\!/ \times 9\!\!\!/ \times 10\!\!\!/7\!\!\!/1}{17\!\!\!/ \times 13\!\!\!/5\!\!\!/} = 21 \text{ days}$$

(4)...

| per. da. | | per. da. | | £  s. | | |
|---|---|---|---|---|---|---|
| 5 × 28 | : | 9 × 25 | :: | 87  10 | : | $x$ |
| | | | | 20 | | |
| | | | | $\overline{1750}$ | | |

$$x = \frac{9 \times 25\!\!\!/ \times 175\!\!\!/0\!\!\!/}{5\!\!\!/ \times 28\!\!\!/} = \frac{5625}{2}s. = \pounds140 \ 12s. \ 6d.$$

(5)... $13\frac{7}{9} + 8\frac{6}{7} = 13\frac{49}{63} + 8\frac{54}{63} = 22\frac{40}{63}$, sum

$13\frac{7}{9} - 8\frac{6}{7} = 13\frac{49}{63} - 8\frac{54}{63} = 4\frac{58}{63}$, difference

$13\frac{7}{9} \times 8\frac{6}{7} = \frac{124}{9} \times \frac{62}{7} = \frac{7688}{63} = 122\frac{2}{63}$, product

$$13\frac{7}{9} \div 8\frac{6}{7} = \frac{\overset{2}{\cancel{124}}}{9} \times \frac{7}{\cancel{62}} = \frac{14}{9} = 1\frac{5}{9},\ \text{quotient}$$

(6)... $\cdot 35 = \frac{35}{100} \div \frac{5}{5} = \frac{7}{20}$ ; $\quad \cdot 056 = \frac{56}{1000} \div \frac{8}{8} = \frac{7}{125}$ ;

$\cdot 275 = \frac{275}{1000} \div \frac{25}{25} = \frac{11}{40}$ ; $\cdot 0155 = \frac{155}{10000} \div \frac{5}{5} = \frac{31}{2000}$.

(7)... 5 per cent. = $\frac{1}{20}$
4 mo. = $\frac{1}{3}$ yr.
1 mo. = $\frac{1}{4}$ of 4 mo.

| | £ | s. | d. | |
|---|---|---|---|---|
| | 736 | 10 | 0 | |
| | 36 | 16 | 6 | int. for 1 year |
| | 12 | 5 | 6 | |
| | 3 | 1 | 4½ | |
| £15 | 6 | 10½ | | int. for 5 mo. |

(8)...Amount of £100 in 8 months at $3\frac{3}{4}$ per cent. per annum
$= £100 + (£3\frac{3}{4} \times \frac{2}{3}) = £102\ 10s.$

| £ | s. | | £ | s. | | £ | | |
|---|---|---|---|---|---|---|---|---|
| 102 | 10 | : | 59 | 15 | :: | 100 | : | present worth |
| 20 | | | 20 | | | | | |
| 2050 | | | 1195 | | | | | |

Present worth $\dfrac{1195 \times \overset{2}{\cancel{100}}}{\underset{41}{\cancel{2050}}} = £\dfrac{2390}{41} = £58\ 5s.\ 10\frac{10}{41}d.$

(9)...

$$5\ 75\ 53\ 96\ 11\ 11\ 62\ 92\ 9\ (75864327$$
$$49$$

$145)\ \overline{855}$
$\phantom{145)\ }725$

$1508)\overline{13039}$
$\phantom{1508)}12064$

$15166)\ \overline{\phantom{0}97561}$
$\phantom{15166)\ \phantom{0}}90996$

$151724)\ \overline{656511}$
$\phantom{151724)\ }606896$

$1517283)\ \overline{4961516}$
$\phantom{1517283)\ }4551849$

$15172862)\ \overline{40966729}$
$\phantom{15172862)\ }30345724$

$151728647)\overline{1062100529}$
$\phantom{151728647)}\underline{1062100529}$

(10)...    Let $x =$ the mean proportional

Then       $148\ \ :\ \ x\ ::\ \ x\ \ :\ \ 333$
$$x^2 = 148 \times 333$$
$$= 49284$$
$$\therefore x = 222$$

## *EXERCISE CXVII.*

1.  $\dfrac{3\frac{3}{4}}{8\frac{2}{5}} - \dfrac{5\frac{1}{7}}{10\frac{1}{2}} + \dfrac{2\frac{4}{7}}{6\frac{6}{11}} - \dfrac{1\frac{2}{9}}{8\frac{5}{9}} = \frac{25}{56} - \frac{10}{21} + \frac{11}{28} - \frac{1}{7}$

$\phantom{1.\ \dfrac{3\frac{3}{4}}{8\frac{2}{5}} - \dfrac{5\frac{1}{7}}{10\frac{1}{2}} + \dfrac{2\frac{4}{7}}{6\frac{6}{11}} - \dfrac{1\frac{2}{9}}{8\frac{5}{9}}} = \frac{75}{168} - \frac{80}{168} + \frac{66}{168} - \frac{24}{168}$

$\phantom{1.\ \dfrac{3\frac{3}{4}}{8\frac{2}{5}} - \dfrac{5\frac{1}{7}}{10\frac{1}{2}} + \dfrac{2\frac{4}{7}}{6\frac{6}{11}} - \dfrac{1\frac{2}{9}}{8\frac{5}{9}}} = \frac{37}{168}$

2.  $\dfrac{3}{7} + \dfrac{3}{5} + \dfrac{4}{9} = \dfrac{135 + 189 + 140}{315} = \dfrac{464}{315}$

$\dfrac{7}{9} + \dfrac{5}{7} + \dfrac{4}{5} = \dfrac{245 + 225 + 252}{315} = \dfrac{722}{315}$

$\dfrac{464}{315} \div \dfrac{722}{315} = \dfrac{\overset{232}{\cancel{464}}}{\cancel{315}} \times \dfrac{\cancel{315}}{\underset{361}{\cancel{722}}} = \dfrac{232}{361}$

(2)...
$$\frac{11}{15} \text{ sov.} = \frac{11}{\cancel{15}_{3}} \times \frac{\overset{4}{\cancel{20}}}{1} = \frac{44}{3}s. = \overset{s.\quad d.}{14\quad 8}$$

$$\tfrac{11}{16} \text{ gui.} = \tfrac{11}{16} \times \tfrac{21}{1} = \tfrac{231}{16}s. = \underline{14\quad 5\tfrac{1}{4}}$$
$$\text{difference} = \quad\overline{2\tfrac{3}{4}d.}$$

(3)...£2·3125 = £2 6s. 3d.        11·6875 cr. = £2 18s. 5¼d.
$$\begin{array}{r} 20 \\ \hline 6\text{·}2500s. \\ 12 \\ \hline 3\text{·}0000d. \end{array} \qquad \begin{array}{r} 5 \\ \hline 3\text{·}4375s. \\ 12 \\ \hline 5\text{·}2500d. \\ 4 \\ \hline 1\text{·}0000 \text{ far.} \end{array}$$

$$\frac{7}{18} \text{ gui.} = \frac{7}{\cancel{18}_{6}} \times \frac{\overset{7}{\cancel{21}}}{1} = \frac{49}{6}s. = 8s.\ 2d.$$

$$\frac{9}{16}s. = \frac{9}{\cancel{16}_{4}} \times \frac{\overset{3}{\cancel{12}}}{1} = \frac{27}{4}d. = 6\tfrac{3}{4}d.$$

$$\begin{array}{rccc} & £ & s. & d. \\ £2\text{·}3125 = & 2 & 6 & 3 \\ 7\tfrac{7}{18} \text{ gui.} = & 7 & 15 & 2 \\ 11\text{·}6875 \text{ cr.} = & 2 & 18 & 5\tfrac{1}{4} \\ 19\tfrac{9}{16}s. = & & 19 & 6\tfrac{3}{4} \\ \hline & £13 & 19 & 5 \end{array}$$

(4)...
$$\begin{array}{ccccccc} \text{da. hrs.} && \text{da. hrs.} &&& s. & \\ 8\times9 & : & 12\times10 & :: & 30 & : & x \end{array}$$

$$x = \frac{\overset{3}{\cancel{12}} \times \overset{5}{\cancel{10}} \times \overset{10}{\cancel{30}}}{\underset{\cancel{2}}{\cancel{8}} \times \underset{\cancel{3}}{\cancel{9}}} = 50s. = £2\ 10s.$$

T 2

(5)...        No. of ranks $= 2500 \div 4 = 625$

No. of spaces between ranks $= 624$

Length of procession $= (15 \overset{\text{in.}}{\times} 625) + (42 \overset{\text{in.}}{\times} 624)$

$$= \overset{\text{in.}}{\cdot 9375} + \overset{\text{in.}}{36208}$$

$$= 35583 \text{ inches}$$

$$= 988 \text{ yds. 1 ft. 3 in.}$$

(6)...      $£3 \cdot 8\overset{.}{6} = £3\dfrac{86-8}{90} = £3\dfrac{78}{90} = £3\dfrac{13}{15} \text{ per oz.}$

$7 \cdot 58\overset{.}{3} \text{ lb.} = 7\dfrac{583-58}{900} \text{ lb.} = 7\dfrac{525}{900} \text{ lb.} = 7\dfrac{7}{12} \text{ lb.}$

$£3\tfrac{13}{15} \times 12 \times 7\tfrac{7}{12} = \dfrac{58}{15} \times \dfrac{\cancel{12}}{1} \times \dfrac{91}{\cancel{12}} = £\dfrac{5278}{15}$

$$= £351\tfrac{13}{15} = £351 \ 17s. \ 4d.$$

(7)...      $£ \cdot 5\overset{.}{3} = £\dfrac{53-5}{90} = £\dfrac{48}{90} = £\dfrac{8}{15} = 10s. \ 8d.$

$$
\begin{array}{ccc}
£ & s. & d. \\
0 & 10 & 8 \text{ per oz.} \\
& & 6 \times 7 + 1 = 43 \\
\hline
3 & 4 & 0 \\
& & 7 \\
\hline
22 & 8 & 0 \\
10 & 8 \\
5 & 4 \\
& 8 \\
\hline
£23 & 4 & 8 \\
\end{array}
$$

10 dwt. $= \tfrac{1}{2}$ of 1 oz.
1 dwt. 6 grs. $= \tfrac{1}{8}$ of 10 dwt.

(8)... Amount of £100 in $3\tfrac{1}{3}$ yrs. at $4\tfrac{1}{2}$ per cent. per annum

$$= £100 + (£4\tfrac{1}{2} \times 3\tfrac{1}{3}) = £115$$

$$
\begin{array}{ccccccccc}
£ & & £ & s. & d. & & £ & & £ & s. & d. \\
115 & : & 202 & 4 & 2 & :: & 100 & : & 175 & 16 & 8 \\
\end{array}
$$

(9)...   12½ per cent. $=\frac{1}{8}$|

$$
\begin{array}{ccc}
\pounds & s. & d. \\
1 & 17 & 4 \\
\end{array}
$$

required profit      4   8

selling price    £2   2   0 per cwt.

1 cwt. = 112 $\left\{\begin{array}{l} \end{array}\right.$

$$
\begin{array}{ccc}
 & \pounds & s. & d. \\
4) & 2 & 2 & 0 \\
4) & & 10 & 6 \\
7) & & 2 & 7\frac{1}{2} \\
\hline
 & & & 4\frac{1}{2}d. \text{ per lb.}
\end{array}
$$

(10)...   $5\sqrt{75}+2\sqrt{48}-3\sqrt{108}+6\sqrt{27}-\sqrt{192}$

$= 5\sqrt{25\times3}+2\sqrt{16\times3}-3\sqrt{36\times3}+6\sqrt{9\times3}-\sqrt{64\times3}$

$= 25\sqrt{3}+8\sqrt{3}-18\sqrt{3}+18\sqrt{3}-8\sqrt{3}$

$= 25\sqrt{3}$

## EXERCISE CXVIII.

(1)...1. 18 in. $=\frac{1}{2}$ of 1 yd.

$$
\begin{array}{ccc}
\pounds & s. & d. \\
0 & 3 & 6 \text{ per yard} \\
 & & 19 \\
\hline
3 & 6 & 6 \\
\end{array}
$$

9 in. $=\frac{1}{2}$ of 18 in.    1   9

4½ „ $=\frac{1}{2}$ of 9 in.     10½

            5¼

       £3   9   6¾

2.

ft. in.         $\pounds$   $s.$   $d.$

4 72 $=\frac{1}{2}$ of 1 sq. yd.   1   10   0 per square yard

                  25

            37 10   0

2 36 $=\frac{1}{2}$ of 4½ ft.    15   0

1 18 $=\frac{1}{2}$ of 2¼ ft.     7   6

                   3   9

       £38 16   3

  ft. in.      £ s d.

3. 13 864 = ½ of 1 c. yd. | 3 3 0 per cubic yard

              13

            40 19 0

  4 864 = ⅓ of 13½ ft.  1 11 6

   972 = ⅛ of 4½ ft.   10 6

             1 3¾

          £43 2 3¾

(2)...1.

$$\frac{5\frac{2}{5}\ \text{of}\ 7\frac{2}{3}}{8\frac{7}{24} - 3\frac{5}{12}} = \frac{\overset{3}{\cancel{\frac{27}{5}}} \times \overset{13}{\cancel{\frac{65}{9}}}}{8\frac{7}{24} - 3\frac{10}{24}} = \frac{39}{4\frac{21}{24}} = \frac{39 \times \overset{8}{\cancel{24}}}{\underset{3}{\cancel{117}}} = 8$$

  2. $\dfrac{1}{7\frac{1}{9}} = \dfrac{9}{64},\quad \dfrac{1}{5\frac{9}{64}} = \dfrac{64}{329},\quad \dfrac{1}{3\frac{64}{329}} = \dfrac{329}{1051}$

    da. hrs.  da. hrs.  s.   s.

(3)...   6×10 : 8×$x$ :: 30 : 46

$$x = \frac{\overset{2}{\cancel{6}} \times \cancel{10} \times \overset{23}{\cancel{46}}}{\underset{4}{\cancel{8}} \times \underset{3}{\cancel{30}}} = \frac{23}{2}\ \text{hrs.} = 11\frac{1}{2}\ \text{hours per day}$$

             s. d.  £ s. d.

(4)...  7⅝ yds. Cloth............12 6 = 4 15 3¾

    3 9/16  „ Silk Velvet ... 7 4 = 1 6 1¼

    14½  „ Lutestring ... 3 10 = 2 16 6¾

    7⅓  „ Flannel......... 1 9 = 0 13 1¼

    26⅔  „ Calico ......... 0 7½ = 0 16 6¾

    16  „ Ribbon ......... 0 5½ = 0 7 4

                  10 15 0

    Discount, 2½ per cent. = $\frac{1}{40}$   5 4½

             £10 9 7½

(5)... £6·69375 = £6$\frac{111}{160}$    11·142857 cwt. = 11$\frac{1}{7}$ cwt.

$$\begin{array}{ccccc} \text{cwt.} & & \text{cwt.} & & \text{\pounds} \\ 3\frac{9}{14} & : & 11\frac{1}{7} & :: & 6\frac{111}{160} & : & x \end{array}$$

$$x = \frac{\cancel{14}^{\,2}}{\cancel{51}}\times\frac{78}{7}\times\frac{\cancel{1071}^{\,21}}{\cancel{160}_{\substack{80 \\ 40}}} = \pounds\frac{819}{40} = \pounds20\ 9s.\ 6d.$$

(6)...     3$\frac{1}{2}$ E. ells. = $\frac{7}{2}\times\frac{5}{4}$ = $\frac{45}{8}$ = 4$\frac{3}{8}$ yds.

$$\begin{array}{ccccc} \text{yds.} & & \text{yds.} & & \text{\pounds} \\ 4\frac{3}{8} & : & 37\frac{5}{8} & :: & 1\frac{5}{16} & : & x \end{array}$$

$$x = \frac{\cancel{8}}{\cancel{35}_{5}}\times\frac{301}{\cancel{8}}\times\frac{\cancel{21}^{\,3}}{16} = \pounds\frac{903}{80} = \pounds11\ 5s.\ 9d.$$

(7)...
$$\begin{array}{rccc} & \text{qrs.} & \text{bu.} & \text{pks.} \\ & 4 & 5 & 2 \\ & & & 17 \\ \hline & 79 & 5 & 2 \\ 2\ \text{roods} = & 2 & 2 & 3 \\ 20\ \text{perches} = & & 4 & 2\frac{3}{4} \\ \hline & 82 & 4 & 3\frac{3}{4} \end{array}$$

(8)...
$$\begin{array}{lrcrrr} & & s. & d. & \pounds & s. & d. \\ 64\ \text{lb. Black Tea}......& 3 & 2 & = & 10 & 2 & 8 \\ 16\ \text{,,}\quad \text{Green}\ \text{,,}\ ......& 4 & 0 & = & 3 & 4 & 0 \\ \hline 80\ \text{,,} & & \text{cost} & & \pounds13 & 6 & 8 \end{array}$$

$$\begin{array}{lcc} & s. & d. \\ 80\ \text{lb. Mixed Tea}.........3 & 9 & = \pounds15 \end{array}$$

Profit = £15 − £13  6s. 8d. = £1 13s. 4d.

$$\begin{array}{cccccccccc} \pounds & s. & d. & & \pounds & s. & d. \\ 13 & 6 & 8 & : & 1 & 13 & 4 & :: & 100 & : & 12\frac{1}{2}\ \text{per cent.} \end{array}$$

(9)...      $(\cdot 833 \text{ &c.})^2 \times (\cdot 8181 \text{ &c.})^2 = (\tfrac{5}{6})^2 \times (\tfrac{9}{11})^2$

$$= \frac{25}{\cancel{36}_{4}} \times \frac{\cancel{81}^{9}}{121} = \frac{225}{484}$$

(10)...   $\sqrt{180} - \sqrt{320} + \sqrt{605} + \sqrt{20} - \sqrt{245}$

$\quad = \sqrt{36 \times 5} - \sqrt{64 \times 5} + \sqrt{121 \times 5} + \sqrt{4 \times 5} - \sqrt{49 \times 5}$

$\quad = 6\sqrt{5} - 8\sqrt{5} + 11\sqrt{5} + 2\sqrt{5} - 7\sqrt{5}$

$\quad = 4\sqrt{5}$

## EXERCISE CXIX.

(1)...            $2s.\ 6d. = \tfrac{5}{21}$ of half-a-guinea

$$\frac{9}{16} \text{ hf. cr.} = \frac{\cancel{9}^{3}}{16} \times \frac{5}{\cancel{21}_{7}} = \frac{15}{112} \text{ of half-a-guinea}$$

$\cdot 656 = \tfrac{656}{1000} = \tfrac{82}{125}$      £1 16s. $5\tfrac{1}{2}d.$ = 1750 farthings

$$\frac{82}{\cancel{125}} \times \frac{\cancel{1750}^{14}}{1} = 1148 \text{ far.} = £1\ 3s.\ 11d.$$

(2)...   $\dfrac{17\tfrac{3}{5}}{23\tfrac{3}{8}} = \dfrac{\tfrac{88}{5}}{\tfrac{187}{8}} = \dfrac{\cancel{88}^{8} \times 8}{\cancel{187}_{17} \times 5} = \dfrac{64}{85}$;   £10 5s. 5d. = 2465d.

$$\frac{64}{\cancel{85}} \times \frac{\cancel{2465}^{29}}{1} = 1856d. = £7\ 14s.\ 8d.$$

(3)... The first five months of 1867 contained 151 days

$$\begin{array}{ccccccc}
\text{da.} & & \text{da.} & & \text{£} & \text{s.} & \\
365 & : & 151 & :: & 36 & 10 & : & x \\
\end{array}$$

$$\begin{array}{c}
20 \\
\hline
730 \\
\end{array}$$

$$x = \frac{151 \times \overset{2}{\cancel{730}}}{\cancel{365}} = 302s. = £15 \ 2s.$$

$$\begin{array}{lcc}
 & & £ \quad s. \\
\text{Rent of house for the year} & & 36 \ 10 \\
\text{do. for first 5 months} & & 15 \ 2 \\
\text{do. for remainder of year} & & \overline{21 \ 8} \\
\end{array}$$

(4)... $£4 \ 9s. \ 3d. = £4\frac{37}{80}; \ 13\frac{1}{2} \ \text{gui.} = £14\frac{7}{40}$

$$\begin{array}{ccccccc}
£ & & £ & & \text{yds.} & & \\
4\frac{37}{80} & : & 14\frac{7}{40} & :: & 19\frac{5}{8} & : & x \\
\end{array}$$

$$x = \frac{\cancel{80}}{\cancel{357}} \times \frac{\overset{63}{\cancel{189}}}{\cancel{40}} \times \frac{\cancel{119}}{\cancel{6}} = 63 \text{ yards}$$

(5)...

$$\begin{array}{ccccccccc}
\text{men da. hrs.} & & \text{men da. hrs.} & & \text{yds. yds.} & & \text{yds. yds.} \\
4 \times 3 \times 10\frac{1}{2} & : & 3 \times 5 \times x & :: & 189 \times 160 & : & 275 \times 144 \\
\end{array}$$

$$x = \frac{\cancel{4} \times \cancel{3} \times \cancel{10\frac{1}{2}} \times \cancel{275} \times \cancel{144}}{\cancel{3} \times \cancel{5} \times \cancel{189} \times \cancel{160}} = 11 \text{ hours}$$

(6)...

$$\begin{array}{ccccccc}
£ & & £ & & £ & & \\
71\frac{3}{4} & : & 2500 & :: & 3\frac{1}{2} & : & x \\
4 & & & & 4 & & \\
\hline
287 & & & & 14 & & \\
\end{array}$$

$$x = \frac{2500 \times \overset{2}{\cancel{14}}}{\cancel{287}} = £\frac{5000}{41} = £121 \ 19s. \ 0\frac{13}{41}d.$$

(7)...        Cost of £100 stock $= £73\frac{5}{8} + 2s.\ 6d. = £73\frac{3}{4}$

$$\underset{295}{\overset{\pounds}{\underset{4}{73\tfrac{3}{4}}}} \ : \ \underset{16579}{\overset{\pounds}{\underset{4}{4144\tfrac{3}{4}}}} \ :: \ \overset{\pounds}{100} \ : \ x$$

$$x = \frac{\cancel{16579} \times \cancel{100}}{\cancel{295}} = \pounds 5620$$

$$\begin{array}{cc} 281 & 20 \\ \end{array}$$
$$59$$

(8)...            $\cdot 357357\ \&c. = \frac{357}{999} = \frac{119}{333}$

$\cdot 357373\ \&c. = \dfrac{3573-35}{9900} = \dfrac{3538}{9900} = \dfrac{1769}{4950}$

(9)...                  $\overline{65}\,\overline{71}\,\overline{12}\,\overline{20}\,\overline{96}\,\overline{4}(256342$
$$\begin{array}{r} 4 \\ \hline 45)\ 257 \\ 225 \\ \hline 506)\ 3211 \\ 3036 \\ \hline 5123)\ 17522 \\ 15369 \\ \hline 51264)\ 215309 \\ 205056 \\ \hline 512682)\ 1025364 \\ 1025364 \\ \hline \end{array}$$

$$\sqrt{141\tfrac{55}{289}} = \sqrt{\tfrac{40804}{289}} = \tfrac{202}{17} = 11\tfrac{15}{17}$$

(10)...            $52542\tfrac{1126}{1331} = \tfrac{69934628}{1331}$

$$\sqrt[3]{\tfrac{69934628}{1331}} = \tfrac{412}{11} = 37\tfrac{5}{11}$$

## EXERCISE CXX.

(1)...From 10.10 P.M. January 6th to 1.13 P.M. January 7th
= 15 hours 3 minutes

$$\begin{array}{ccccc} \text{hrs.} & \text{min.} & \text{hr.} & & \text{miles} \\ 15 & 3 & : & 1 & :: & 515 & : & x \\ & 60 & & 60 \\ \hline & 903 & & 60 \end{array}$$

$$20$$

$$x = \frac{\cancel{60} \times 515}{\cancel{903}} = \frac{10300}{301} \text{ mi.} = 34\tfrac{66}{301} \text{ miles}$$
$$301$$

(2)...
$$\begin{array}{ccccc} \text{hrs.} & \text{min.} & \text{hrs.} & & \text{hr.} & & \text{miles} \\ 2 & 25 = 2\tfrac{5}{12} & : & 1 & :: & 130\tfrac{1}{2} & : & x \end{array}$$

$$\begin{array}{cc} 6 & 9 \\ x = \dfrac{\cancel{12}}{\cancel{29}} \times \dfrac{\cancel{261}}{\cancel{2}} = 54 \text{ miles} \end{array}$$

(3)...

$$\frac{11}{18} \text{ gui.} = \frac{11}{\cancel{18}} \times \frac{\overset{7}{\cancel{21}}}{1} = \frac{77}{6} = \begin{array}{cc} s. & d. \\ 12 & 10 \end{array}$$
$$6$$

$$\frac{13}{32} \text{ sov.} = \frac{13}{\cancel{32}} \times \frac{\overset{5}{\cancel{20}}}{1} = \frac{65}{8} = \quad 8 \quad 1\tfrac{1}{2}$$
$$8$$

$$\frac{9}{20} \text{ cr.} = \frac{9}{\cancel{20}} \times \frac{\cancel{5}}{1} = \frac{9}{4} = \quad 2 \quad 3$$
$$4$$

$$\frac{7}{24} = \dfrac{\begin{array}{ccc} & & 3\tfrac{1}{2} \\ \hline \pounds 1 & 3 & 6 \end{array}}{}$$

$$\begin{array}{c} d. \\ 12\overline{)6} \\ 20\overline{)3\cdot 5} \\ 5\overline{)1\cdot 175} \end{array}$$

$$\pounds 1 \; 3s. \; 6d. = \cdot 235 \text{ of } \pounds 5$$

(4)...         4·96875 cwt. × 7 = 34·78125 cwt.

$$
\begin{array}{ccccc}
\text{cwt.} & & \text{cwt.} & & \pounds \\
5{\cdot}\cancel{96875} & : & 34{\cdot}78125 & :: & 11{\cdot}\cancel{878125} \\
& & 2{\cdot}1 & & 2{\cdot}1 \\
\end{array}
$$

$$
\begin{array}{r}
\overline{3478125} \\
6956250 \\
\hline
\pounds 73{\cdot}040625 = \pounds 73 \; 0s. \; 9\tfrac{3}{4}d. \\
20 \\
\hline
0{\cdot}812500s. \\
12 \\
\hline
9{\cdot}750000d. \\
4 \\
\hline
3{\cdot}000000 \text{ far.}
\end{array}
$$

(5)...
$$
\begin{array}{cccccc}
\text{men} & \text{wks.} & \text{hrs.} & \text{men} & \text{wks.} & \text{hrs.} \\
200 & \times 22 & \times 12 & : 350 & \times x \times 10 \\
\end{array}
:: 
\begin{array}{ccc}
\text{mi.} & \text{yds.} & \text{ft.} \\
7\tfrac{1}{2} & \times 12 & \times 6 \\
\end{array}
:
\begin{array}{ccc}
\text{mi.} & \text{yds.} & \text{ft.} \\
25 & \times 15 & \times 7
\end{array}
$$

$$
x = \frac{\overset{4}{\cancel{200}} \times \overset{11}{\cancel{22}} \times \overset{}{\cancel{12}} \times \overset{5}{\cancel{25}} \times \overset{}{\cancel{15}} \times 7}{\underset{7}{\cancel{350}} \times \underset{}{\cancel{10}} \times 7\tfrac{1}{2} \times \underset{}{\cancel{12}} \times \underset{3}{\cancel{6}}} = \frac{220}{3} \text{ wks.} = 73\tfrac{1}{3} \text{ weeks}
$$

(6)...
$$
\begin{array}{lll}
 & & \pounds \;\; s. \;\; d. \\
70 \text{ lb. at } 2s. \; 10d. \text{ per lb.} = & 9 \;\; 18 \;\; 4 \\
85 \text{ lb. at } 3s. \; 2d. \qquad ,, \;\; = & 13 \;\; 9 \;\; 2 \\
\overline{155} \text{ lb.} \qquad\qquad \text{cost} & \pounds 23 \;\; 7 \;\; 6
\end{array}
$$

155 lb. at 3s. 6d. per lb. = £27 2s. 6d.

£27 2s. 6d. − £23 7s. 6d. = £3 15s. gain

$$
\begin{array}{ccccccc}
\pounds & s. & d. & & \pounds & s. & & \pounds \\
23 & 7 & 6 & : & 3 & 15 & :: & 100 & : & 16\tfrac{8}{187} \text{ per cent.}
\end{array}
$$

(7)... From March 14th, 1860, to August 7th, 1863=1241 da.

$$
\begin{array}{llll}
 & & \pounds & s. & d. \\
4 \text{ per cent.} = \frac{1}{25} & 478 & 15 & 0 \\
\frac{1}{2} \quad ,, \quad = \frac{1}{8} & 19 & 3 & 0 \\
 & & 2 & 7 & 10\frac{1}{2} \\
 & \pounds 21 & 10 & 10\frac{1}{2} \text{ int. for 1 year}
\end{array}
$$

$$
\begin{array}{cccccc}
\text{da.} & & \text{da.} & & \pounds & s. & d. \\
365 & : & 1241 & :: & 21 & 10 & 10\frac{1}{2} \\
5 & & 17 & & & & 17 \\
 & & & & 5)366 & 4 & 10\frac{1}{2} \\
 & & & & \pounds 73 & 4 & 11\frac{7}{10}
\end{array}
$$

(8)...Amount of £100 in 1 year at $3\frac{1}{4}$ per cent. = £103 5s.

$$
\begin{array}{ccccccc}
\pounds & s. & & \pounds & s. & d. & & \pounds & & \pounds \\
103 & 5 & : & 376 & 17 & 3 & :: & 100 & : & 365
\end{array}
$$

$$
\begin{array}{llll}
 & & \pounds & s. & d. \\
(9)...5 \text{ per cent.} = \frac{1}{20} & 325 & 0 & 0 \text{ principal} \\
 & 16 & 5 & 0 \text{ int. for 1st year} \\
,, \quad ,, \quad ,, & 341 & 5 & 0 \text{ amount at end of 1st year} \\
 & 17 & 1 & 3 \text{ int. for 2nd year} \\
,, \quad ,, \quad ,, & 358 & 6 & 3 \text{ amount at end of 2nd year} \\
 & 17 & 18 & 3\frac{3}{4} \text{ int. for 3rd year} \\
,, \quad ,, \quad ,, & 376 & 4 & 6\frac{3}{4} \text{ amount at end of 3rd year} \\
 & 18 & 16 & 2\frac{59}{80} \text{ int. for 4th year} \\
 & \pounds 395 & 0 & 9\frac{39}{80} \text{ amount in 4 years}
\end{array}
$$

(10)...

$$5 + 3\sqrt{7} = 5 + (2{\cdot}64575131 \times 3)$$

$$= 5 + 7{\cdot}93725393$$

$$= 12{\cdot}93725393$$

$$\sqrt{5 + 3\sqrt{7}} = 3{\cdot}5968......$$

*EXERCISE CXXI.*

(1)... 1.    $13\frac{5}{13}$  :  $29\frac{7}{9}$  ::  145  :  $x$

$$x = \frac{13}{\cancel{174}}\times\frac{\cancel{268}}{9}\times\frac{\cancel{145}}{1} = \frac{8710}{27} = 322\frac{16}{17}$$

2.    $46\frac{3}{7}$  :  $13\frac{10}{11}$  ::  $x$  :  $8\frac{1}{2}$

$$x = \frac{\cancel{324}}{7}\times\frac{\cancel{17}}{\cancel{2}}\times\frac{11}{\cancel{153}} = \frac{198}{7} = 28\frac{2}{7}$$

3.    ·065  :  $x$  ::  2·34  :  33·732

$x = (·065 \times 33·732) \div 2·34$
$\quad = 2·19258 \div 2·34$
$\quad = ·937$

4.    $x$  :  7·089  ::  6·8595  :  5·31675

$x = (7·089 \times 6·8595) \div 5·31675$
$\quad = 48·6269955 \div 5·31675$
$\quad = 9·146$

(2)...    Weight of paper consumed in each week
$\quad = £120 \div 1\frac{1}{2}d. = 19200$ lb.

Weight of each copy $= 19200$lb. $\div 100000$
$\qquad\qquad\qquad = 307200$ oz. $\div 100000$
$\qquad\qquad\qquad = 3$ oz. $1\frac{19}{125}$ dr.

(3)...    £30 12s. 6d. $= 7350$ pence
$\qquad 7350 \div 7 = £1050$ annual income

(4)...          £158 11*s.* 5*d.* = 152228 farthings

1 sov., 1 hf. sov., 1 cr., 1 hf. cr., 1 flo., 1 sh., 1 sixp., 1 fourp.,
1 threep., 1 penny, 1 hf. penny, 1 far. = £2 1*s.* 8¾*d.*
          = 2003 farthings

          152228÷2003 = 76 of each coin

(5)...          $29\frac{5}{8} = 29 \cdot 625$          $7 \cdot 025 = 7\frac{1}{40}$

$$29\frac{5}{8} \times 7\frac{1}{40} = \frac{237}{8} \times \frac{281}{40} = \frac{66597}{320} = 208\frac{37}{320}$$

          29·625
          7·025
          ‾‾‾‾‾‾
          148125
          59250
          207375
          ‾‾‾‾‾‾
          208·115625

$240 \cdot 65625 = 240\frac{21}{32}$          $47\frac{3}{16} = 47 \cdot 1875$

$$240\frac{21}{32} \div 47\frac{3}{16} = \frac{\overset{51}{\cancel{7701}}}{\underset{2}{\cancel{32}}} \times \frac{\cancel{16}}{\underset{5}{\cancel{755}}} = \frac{51}{10} = 5\frac{1}{10}$$

          47·1875)240·65625(5·1
          2359375
          ‾‾‾‾‾‾
          471875
          471875

```
       £    s.  yrs.        £    s.  d.  yrs.        £    s.
(6)...376  15 × 4    :    642  13  4 × 5½   ::    75   7    :   x
       20    2              20        2              20
      ‾‾‾‾   ‾‾           ‾‾‾‾‾      ‾‾            ‾‾‾‾
      7535    8            12853     11            1507
        12                   12
      ‾‾‾‾‾                ‾‾‾‾‾‾
      90420                154240
```

$$x = \frac{\overset{964}{\underset{7712}{\cancel{154240}}} \times 11 \times \cancel{1507}}{\underset{\underset{3}{\cancel{60}}}{\cancel{90420}} \times \cancel{8}} = \frac{10604}{3}s. = £176 \ 14s. \ 8d.$$

(7)...      20 cwt. 1 qr. Avoird. = 15876000 grains

$5\frac{1}{4}$ lb. Troy = 30240 grains

15876000 ÷ 30240 = 525 parcels

(8)...See *"Answers."*

(9)...      From March 19 to October 24 = 219 days

$$\text{4 per cent.} = \tfrac{1}{25}) \begin{array}{ccc} £ & s. & d. \\ 380 & 4 & 2 \end{array}$$

$$\overline{£15 \quad 4 \quad 2} \text{ int. for 1 year}$$

$$\begin{array}{ccccccc} \text{da.} & & \text{da.} & & £ & s. & d. \\ 365 & : & 219 & :: & 15 & 4 & 2 \\ 5 & & 3 & & & & 3 \end{array}$$

$$5)\overline{45 \quad 12 \quad 6}$$

$$\overline{£9 \quad 2 \quad 6}$$

(10)...Amount of £100 in 9 months at 5 per cent. per annum
= £100 + (£5 × ¾) = £103 15*s*.

$$\begin{array}{ccccccccc} £ & s. & & £ & s. & & £ & & £ & s. & d. \\ 103 & 15 & : & 157 & 10 & :: & 100 & ; & 151 & 16 & 1\frac{61}{83} \end{array}$$

## *EXERCISE CXXII.*

$$\begin{array}{lllllll} & & & s. & d. & £ & s. & d. \\ (1)... & 13\frac{3}{4} \text{ yds. Cloth......} & 9 & 6 & = 6 & 10 & 7\frac{1}{2} \\ & 17 \quad ,, \quad \text{Linen ...} & 2 & 3 & = 1 & 18 & 3 \\ & 19 \quad ,, \quad \text{Flannel...} & 1 & 8 & = 1 & 11 & 8 \\ & 10\frac{3}{4} \quad ,, \quad \text{Muslin ...} & 1 & 4 & = & 14 & 4 \\ & 33 \quad ,, \quad \text{Calico ...} & 5\frac{1}{2} & = & 15 & 1\frac{1}{2} \end{array}$$

$$\overline{11 \quad 10 \quad 0}$$

$$\text{Discount, } 2\frac{1}{2} \text{ per cent.} = \tfrac{1}{40} \qquad 5 \quad 9$$

$$\overline{£11 \quad 4 \quad 3}$$

(2)...      $\sqrt{5\frac{4}{9}} \times \sqrt[3]{12\frac{19}{27}} = \frac{7}{3} \times \frac{7}{3} = \frac{49}{9} = 5\frac{4}{9}$

$$(3)\ldots \qquad \frac{19}{56}\text{ gui.} = \frac{19}{\cancel{56}_{8}}\times\frac{\overset{3}{\cancel{21}}}{1} = \frac{57}{8}s. = 7s.\ 1\tfrac{1}{2}d.$$

$$\cdot171875 \text{ of } £5 = 17s.\ 2\tfrac{1}{4}d.$$
$$5$$
$$\overline{\cdot859375} \text{ of } £1$$
$$20$$
$$\overline{17\cdot187500s.}$$
$$12$$
$$\overline{2\cdot250000d.}$$
$$4$$
$$\overline{1\cdot000000} \text{ far.}$$

$$17s.\ 2\tfrac{1}{4}d. - 7s.\ 1\tfrac{1}{2}d. = 10s.\ 0\tfrac{3}{4}d.$$

$$(4)\ldots \qquad \overset{\text{min.}}{60)30}$$
$$24)\overline{19\cdot5}$$
$$7)\ \overline{4\cdot8125}$$
4 da. 19 ho. 30 min. $= \ \overline{\cdot6875}$ of a week

$$(5)\ldots \qquad \cdot47575 \text{ \&c.} = \frac{475-4}{990} = \frac{471}{990} = \frac{157}{330}$$

$$\cdot73636 \text{ \&c.} = \frac{736-7}{990} = \frac{729}{990} = \frac{81}{110}$$

$$\frac{81}{110} - \frac{157}{330} = \frac{243-157}{330} = \frac{86}{330} = \frac{43}{165} = \cdot26060 \text{ \&c.}$$

$$(6)\ldots \qquad 2\tfrac{1}{8}\text{ yds.} + 1\tfrac{1}{8}\text{ yd.} + 1\tfrac{1}{4}\text{ yd.} = 4\tfrac{1}{16}\text{ yds.}$$
$$32\tfrac{1}{2}\text{ yds.} + 4\tfrac{1}{16}\text{ yds.} = 8 \text{ suits}$$

$(7)\ldots$ 

| re. | da. | ho. | | re. | da. | ho. | | yds. | yds | | yds. | yds. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $6\times5\times10$ | | | : | $5\times8\times x$ | | | :: | $300\times242$ | | : | $484\times220$ | |

$$x = \frac{\overset{2}{\cancel{6}}\times\overset{2}{\cancel{5}}\times\overset{2}{\cancel{10}}\times\overset{11}{\cancel{484}}\times\cancel{220}}{\cancel{5}\times\cancel{8}\times\underset{\underset{3}{15}}{\cancel{300}}\times\underset{\cancel{4}}{\cancel{242}}} = 11 \text{ hours}$$

ʊ

(8)...From noon on Monday to 6 A.M. on Friday $=$ 90 hours

The clock marks 24 hours 5 minutes in 24 hours

$$
\begin{array}{ccccc}
\text{ho. min.} & & \text{ho.} & & \text{ho.} \\
24 \quad 5 & : & 90 & :: & 24 \quad : \quad x \\
60 & & 60 & & \\
\hline
1445 & & 5400 & &
\end{array}
$$

$$
x = \frac{\cancel{5400} \times 24}{\cancel{1445}} = \frac{25920}{289} \text{ hrs.} = 89 \text{ hrs. } 41\tfrac{91}{289} \text{ min.}
$$

∴ when the hands point to 6 on Friday morning, the correct time is 5 hours $41\tfrac{91}{289}$ min.

(9)...    $$\frac{3}{10} + \frac{7}{50} + \frac{9}{25} = \frac{15+7+18}{50} = \frac{40}{50} = \frac{4}{5}$$

$$1 - \tfrac{4}{5} = \tfrac{1}{5} = 250 \text{ persons}$$

Total number of persons $=$ 1250

$$
\begin{array}{lll}
& & s. \ d. \qquad \pounds \quad s. \\
\tfrac{3}{10} \text{ of } 1250 = 375 \text{ at } 5 \ 0 = 93 \ 15 \\
\tfrac{7}{50} \text{ of } 1250 = 175 \text{ at } 4 \ 0 = 35 \quad 0 \\
\tfrac{9}{25} \text{ of } 1250 = 450 \text{ at } 2 \ 6 = 56 \quad 5 \\
\tfrac{1}{5} \text{ of } 1250 = 250 \text{ at } 1 \ 0 = 12 \ 10 \\
\qquad\qquad\text{Total receipts} = \pounds \overline{197 \ \ 10s.}
\end{array}
$$

(10)...    $$\sqrt{171\tfrac{1}{169}} = \sqrt{\tfrac{28900}{169}} = \tfrac{170}{13} = 13\tfrac{1}{13}$$

$$\sqrt[3]{405\tfrac{28}{125}} = \sqrt[3]{\tfrac{50653}{125}} = \tfrac{37}{5} = 7\tfrac{2}{5}$$

## EXERCISE CXXIII.

(1)... 1. $\dfrac{5\frac{3}{10}+7\frac{4}{5}}{12\frac{3}{8}-7\frac{1}{2}} = \dfrac{5\frac{3}{10}+7\frac{8}{10}}{12\frac{3}{8}-7\frac{4}{8}} = \dfrac{13\frac{1}{10}}{4\frac{7}{8}} = \dfrac{\frac{131}{10}}{\frac{39}{8}}$

$$= \dfrac{131 \times \overset{4}{\cancel{8}}}{39 \times \underset{5}{\cancel{10}}} = \dfrac{524}{195} = 2\frac{134}{195}$$

2. $\dfrac{3\frac{5}{7} \times 2\frac{4}{5} \times 3\frac{1}{3}}{3\frac{5}{9} \times 1\frac{5}{8} \times 1\frac{1}{2}} = \dfrac{\frac{104}{3}}{\frac{26}{3}} = \dfrac{104}{26} = 4$

3. $\dfrac{\frac{2}{5} \text{ of } \frac{7}{10}}{9\frac{1}{3}} \times \dfrac{2\frac{1}{7}}{8\frac{5}{14}} \times \dfrac{5\frac{1}{3}-2\frac{1}{5}}{3\frac{1}{13}} \times \dfrac{62\frac{1}{2}}{1\frac{4}{5}+1\frac{1}{3}}$

$= \dfrac{\frac{7}{25}}{\frac{28}{3}} \times \dfrac{\frac{15}{7}}{\frac{117}{14}} \times \dfrac{\frac{47}{15}}{\frac{40}{13}} \times \dfrac{\frac{125}{2}}{\frac{47}{15}}$

$= \dfrac{\overset{}{\cancel{3}}}{\underset{4}{\cancel{100}}} \times \dfrac{\overset{5}{\cancel{10}}}{\underset{3}{\cancel{39}}} \times \dfrac{\overset{13}{\cancel{611}}}{\underset{8}{\cancel{600}}} \times \dfrac{\overset{25}{\cancel{1875}}}{\underset{2}{\cancel{94}}}$

$= \dfrac{5}{32}$

(2)...  2 wks. 4 da. 19 hrs. 32 min. = 27092 minutes
      1 month = 40320    „

$\frac{27092}{40320} \div \frac{4}{4} = \frac{6773}{10080}$ of a month

37 wks. 3 da. 18 hrs. = 6306 hours
      365 da. 6 hrs. = 8766    „

$\frac{6306}{8766} \div \frac{6}{6} = \frac{1051}{1461}$ of a year

u 2

$$
\begin{array}{ll}
\text{gui.} & \text{sov.} \\
(3)\ldots\quad \cdot7356 = 15s.\ 5\tfrac{232}{625}d. & \quad \cdot89545 = 17s.\ 10\tfrac{227}{250}d. \\
\quad\quad 21 & \quad\quad 20 \\
\hline
\quad 15\cdot4476s. & \quad 17\cdot90900s. \\
\quad\quad 12 & \quad\quad 12 \\
\hline
\quad 5\cdot3712d. & \quad 10\cdot90800d.
\end{array}
$$

$$
\begin{array}{rl}
s. & d. \\
17 & 10\tfrac{227}{250} \\
15 & 5\tfrac{232}{625} \\
\hline
2 & 5\tfrac{671}{1250}
\end{array}
$$

(4)...2·83 ft.=2⅚ ft.   43·61 ft.=43$\frac{11}{18}$ ft.   19·83 ft.=19⅚ ft.

Area of floor = 43$\frac{11}{18}$ ft. × 19⅚ ft.

Area of 1 yd. of matting = 2⅚ ft. × 3 ft.

No. of yards of matting required

$$= (43\tfrac{11}{18} \times 19\tfrac{5}{6}) \div (2\tfrac{5}{6} \times 3)$$

$$= \frac{785}{18} \times \frac{\overset{7}{\cancel{119}}}{\cancel{6}} \times \frac{\cancel{6}}{\cancel{17}} \times \frac{1}{3}$$

$$= \tfrac{5495}{54}\text{yds.} = 101\tfrac{41}{54}\text{yds.} = 101 \text{ yds. } 2 \text{ ft. } 3\tfrac{1}{3} \text{ in.}$$

(5)...   The trains approach each other at the rate of

(23¾ + 27½ =) 51¼ miles per hour

hence they will meet in 112½ ÷ 51¼ = $\frac{90}{41}$ hours

∴ at the time of meeting the one train will be

23¾ × $\frac{90}{41}$ = 52$\frac{11}{82}$ miles from London

and the other 27½ × $\frac{90}{41}$ = 60$\frac{15}{41}$ miles from Birmingham

$$
\begin{array}{rrl}
£ & s. & d. \\
341 & 1 & 7\tfrac{1}{4} \\
291 & 16 & 8 \\
\hline
£49 & 4 & 11\tfrac{1}{4} \text{ interest in } 4\tfrac{1}{2} \text{ years}
\end{array}
$$

(6)...

£49 4s. 11¼d. ÷ 4½ = £10 18s. 10½d. interest for 1 year

$$
\begin{array}{ccccccccc}
£ & s. & d. & & £ & & £ & s. & d. & & £ \\
291 & 16 & 8 & : & 100 & :: & 10 & 18 & 10\tfrac{1}{2} & : & 3\tfrac{3}{4}\text{ per cent.}
\end{array}
$$

(7)...                      £    s.
                 78 gui. = 81  18  amount
                 65  „   = 68   5  principal
                       · £$\overline{13\ 13}$  interest

                                £   s.   d.
     2½ per cent. = $\frac{1}{40}$|68   5   0
     1¼   „   = ½ | 1  14  1½
                  | 0  17  0¾
                  £2  11  2¼  interest for 1 year

   £  s.  d.        £   s.        yr.        yrs.
   2 11 2¼   :   13  13   ::   1   :   5⅓ = 5 yrs. 4 mo.

(8)...            £                £             £
               77½   :   1750   ::   3½   :   $x$
                2                     2
               $\overline{155}$       $\overline{7}$

                350
          $x = \frac{17\cancel{5}\cancel{0} \times 7}{\cancel{155}} = £\frac{2450}{31} = £79\ 0s.\ 7\frac{33}{31}d.$
                  31

(9)...   $17\sqrt{48} - 11\sqrt{75} + 19\sqrt{192} - 7\sqrt{108}$

    $= 17\ \overline{16 \times 3} - 11\sqrt{25 \times 3} + 19\sqrt{64 \times 3} - 7\sqrt{36 \times 3}$

    $= 68\sqrt{3} - 55\sqrt{3} + 152\ \overline{3} - 42\sqrt{3}$

    $= 123\sqrt{3}$

(10)...
   $\dfrac{\sqrt{10 + \sqrt[3]{1331} + \sqrt{225}}}{\sqrt{9 + \sqrt[3]{729} + \sqrt{961}}} = \dfrac{\sqrt{10 + 11 + 15}}{\sqrt{9 + 9 + 31}} = \dfrac{\sqrt{36}}{\sqrt{49}} = \dfrac{6}{7}$

## EXERCISE CXXIV

(1)... Perimeter of ground $= (136\frac{1}{2}+97\frac{1}{2})\times 2 = 468$ yards

length of each hurdle $= 6$ ft. $6$ in. $= 2\frac{1}{6}$ yards

$$\text{No. of hurdles} = 468 \div 2\frac{1}{6} = \frac{\overset{36}{\cancel{468}}}{1}\times\frac{6}{\cancel{13}} = 216 = 18 \text{ dozen}$$

$$
\begin{array}{ccc}
 & \pounds & s. & d. \\
18 \text{ doz. hurdles at } 13s.\ 6d.\ \text{per doz.} = & 12 & 8 & 0 \\
 & & 17 & 6 \\
\hline
\text{total expense} = \pounds & 13 & 0 & 6 \\
\end{array}
$$

(2)...    At the time of their meeting A has walked

$(\frac{1}{20}\times 3\frac{1}{3} =)\frac{1}{6}$ of a mile more than B

$(28-\frac{1}{6})\div 2 = 13\frac{11}{12}$ miles, the distance B has walked

$13\frac{11}{12}+\frac{1}{6} = 14\frac{1}{12}$ miles, the distance A has walked

hence A's rate of walking $= 14\frac{1}{12}\div 3\frac{1}{3} = 4\frac{9}{30}$ miles per hour

and B's     ,,       ,,    $= 13\frac{11}{12}\div 3\frac{1}{3} = 4\frac{7}{20}$  ,,    ,,

$$
\begin{array}{cccccccc}
 & \text{per. da.} & d. & & \text{per. da.} & d. & & \pounds & s. & d. & & \\
(3)... & 9\times 30\times 7\frac{1}{2} & : & & 13\times 123\times 8\frac{1}{2} & :: & & 5 & 12 & 6 & : & x \\
 & 2 & & & 2 & & & 20 & & & & \\
 & \overline{15} & & & \overline{17} & & & \overline{112} & & & & \\
 & & & & & & & 12 & & & & \\
 & & & & & & & \overline{1350} & & & & \\
\end{array}
$$

$$x = \frac{13\times \overset{41}{\cancel{123}}\times 17 \times \overset{\overset{3}{\cancel{45}}}{\cancel{1350}}}{\underset{3}{\cancel{9}\times \cancel{30}\times \cancel{15}}} = 9061d. \doteqdot \pounds37\ 15s.\ 1d.$$

(4)... From May 10th to Oct. 17th = 160 days

$$
\begin{array}{llll}
 & \text{cows} & \text{da.} & \\
A & 7 \times 160 & = & 1120 \\
B & 9 \times 120 & = & 1080 \\
C & 8 \times 90 & = & \underline{\phantom{0}720} \\
 & & & 2920
\end{array}
$$

2920 : 1120 :: £18 5s. : £7 A's share

2920 : 1080 :: £18 5s. : £6 15s. B's share

2920 : 720 :: £18 5s. : £4 10s. C's share

(5)... $14\frac{1}{2} \overset{\text{ft.}}{\times} 1\frac{1}{4} \overset{\text{ft.}}{\times} \frac{7}{8} = \frac{29}{2} \times \frac{5}{4} \times \frac{7}{8} = \frac{1015}{64}$ cubic feet

1s. 8d. $= \frac{1}{12}$ of £1

$£\frac{1}{12} \times \frac{1015}{64} = £\frac{1015}{768} = £1\ 6s.\ 5\frac{3}{16}d.$

(6)... $\overset{\text{ac.}}{1} = \overset{\text{per.}}{160} : \overset{\text{ac. ro. per.}}{373\ 2\ 16} = \overset{\text{per.}}{59776} :: \overset{s.\ d.}{37\ 6} = \overset{d.}{450} : x$

$\begin{array}{cc} 3736 & 45 \end{array}$

$x = \dfrac{59776 \times 450}{160} = 168120d. = £700\ 10s.$

$\phantom{x = }\dfrac{}{16}$

10 per cent. $= \frac{1}{10})\overset{£\quad s.}{700\ 10}$ annual rent of farm

$\phantom{10 per cent. = }\overline{£70\quad 1s.}$

(7)...

$$
\begin{array}{rrrr}
 & £ & s. & d. \\
4 : 4\frac{1}{4} :: & 762 & 0 & 0 \\
 & & & 4\frac{1}{4} \\
\hline
 & 3048 & 0 & 0 \\
 & 190 & 10 & 0 \\
\hline
4)\overline{3238} & 10 & 0 & \\
\hline
£809 & 12 & 6 & \\
\end{array}
$$

(8)...        7 for sixpence = $10\frac{2}{7}d.$ per dozen

                    gain = $2\frac{2}{7}d.$          ,,

$$\overset{d.}{8} \quad : \quad \overset{d.}{2\frac{2}{7}} \quad :: \quad 100 \quad : \quad 28\frac{4}{7} \text{ per cent.}$$

$$
\begin{array}{lll}
 & & \overset{\pounds \quad s.}{} \\
42 \text{ dozen at 7 for sixpence} = & 1 & 16 \\
42 \quad ,, \quad ,, \quad 8d. \text{ per dozen} = & 1 & 8 \\
& \text{profit} = & 8s. \\
\end{array}
$$

(9)...        $\pounds6$ $6s.$ $9d.$ = 6084 farthings

            $\sqrt{6084}$ = 78 = No. of lb.

        price per lb. = 78 farthings = $1s.$ $7\frac{1}{2}d.$

(10)...5 per cent. = $\frac{1}{20}$

$$
\begin{array}{lrrl}
 & \pounds & s. & d. \\
 & 1500 & 0 & 0 \text{ principal} \\
 & 75 & 0 & 0 \text{ int. for 1st year} \\
 & 1575 & 0 & 0 \text{ amount at end of 1st year} \\
 & 78 & 15 & 0 \text{ int. for 2nd year} \\
 & 1653 & 15 & 0 \text{ amount at end of 2nd year} \\
 & 82 & 13 & 9 \text{ int. for 3rd year} \\
 & 1736 & 8 & 9 \text{ amount at end of 3rd year} \\
 & 86 & 16 & 5\frac{1}{4} \text{ int. for 4th year} \\
\pounds & 1823 & 5 & 2\frac{1}{4} \text{ amount in 4 years} \\
\end{array}
$$

"             "
"             "
"             "

## *EXERCISE CXXV.*

(1)...                    1.

$$
\begin{array}{rr}
 & \overset{s. \quad\; d.}{16 \quad 8} \text{ per ell} \\
 & 6 \times 6 + 1 = 37 \\
\hline
5 & 0 \quad 0 \\
 & 6 \\
\hline
30 & 0 \quad 0 \\
 & 16 \quad 8 \\
 & 8 \quad 4 \\
 & 4 \quad 2 \\
 & 2 \quad 1 \\
\hline
\pounds 31 & 11 \quad 3 \\
\end{array}
$$

2 qrs. 2  na. = $\frac{1}{2}$ of 1  ell

1 qr. 1  na. = $\frac{1}{3}$ of $2\frac{1}{2}$ qrs.

$2\frac{1}{2}$ na. = $\frac{1}{2}$ of $1\frac{1}{4}$ qr.

$$
\begin{array}{ccc}
£ & s. & d. \\
\end{array}
$$

2.　　　　　3　2　0 per quarter

$5 \times 10 + 3 = 53$

15　10　0

10

| | 155 | 0 | 0 |
|---|---|---|---|
| 4 bu. = $\frac{1}{6}$ of 3 qrs. | 9 | 6 | 0 |
| 1 bu. = $\frac{1}{4}$ of 4 bu. | 1 | 11 | 0 |
| 2 pks. = $\frac{1}{2}$ of 1 bu. | | 7 | 9 |
| 1 gal. = $\frac{1}{4}$ of 2 pks. | | 3 | $10\frac{1}{2}$ |
| | | | $11\frac{5}{8}$ |

£166　9　$7\frac{1}{8}$

3.　10 cwt. = $\frac{1}{2}$ of  1 ton

$$
\begin{array}{cc}
s. & d. \\
12 & 6 \text{ per ton} \\
\end{array}
$$

19

| | 11 | 17 | 6 |
|---|---|---|---|
| $2\frac{1}{2}$ cwt. = $\frac{1}{4}$ of 10 cwt. | | 6 | 3 |
| 1  cwt. = $\frac{1}{10}$ of 10 cwt. | | 1 | $6\frac{3}{4}$ |
| | | | $7\frac{1}{2}$ |

£12　5　$11\frac{1}{4}$

(2)...　　　　$7s.\ 5\frac{1}{4}d.$ = 357 farthings

$15s.\ 9d.$ = 756　　"

$\frac{357}{756} + \frac{21}{21} = \frac{17}{36}$

$9s.\ 1\frac{1}{4}d.$ = 437 farthings

$15s.\ 10d.$ = 760　　"

$\frac{437}{760} + \frac{19}{19} = \frac{23}{40} = ·575$

(3)...

far.

4) 3

12) 0·75

21)17·0625

17s. 0$\frac{3}{4}$d. = ·8125 of a gui.

·4375 of 3 gui. = £1 7s. 6$\frac{3}{4}$d.

63

27·5625s.

12

6·7500d.

4

3·0000 far.

(4)...   $\cdot 6363$ &c. $\times \cdot 533$ &c. $= \frac{7}{11} \times \frac{8}{15} = \frac{56}{165} = \cdot 339393$ &c.

(5)...     $(13 \sqrt{5})^2 = 169 \times 5 = 845$

$$(7 \sqrt{9})^3 = 7^3 \times (\sqrt{9})^3 = 343 \times 9 \times \sqrt{9}$$
$$= 343 \times 9 \times 3$$
$$= 9261$$

(6)...     $\dfrac{3}{10} + \dfrac{2}{5} + \dfrac{7}{20} = \dfrac{6+8+7}{20} = \dfrac{21}{20}$

$$\frac{21}{20} \;:\; \frac{3}{10} \;::\; £157 \; 10s. \;:\; £45$$
$$\frac{21}{20} \;:\; \frac{2}{5} \;::\; £157 \; 10s. \;:\; £60$$
$$\frac{21}{20} \;:\; \frac{7}{20} \;::\; £157 \; 10s. \;:\; £52 \; 10s.$$

(7)...
| ft. in. | ft. in. | ft. in. | ft. in. | £ s. d. | far. |
|---|---|---|---|---|---|
| 21 9 | × 17 6 | : 23 3 | × 14 8 | :: 15 17 2¼ | = 15225 : $x$ |
| 12 | 12 | 12 | 12 | | |
| 261 | 210 | 279 | 176 | | |

$$x = \frac{\cancel{279}^{31} \times \cancel{176}^{88} \times \cancel{15225}^{145 \to 5}}{\cancel{261}^{29} \times \cancel{210}^{7}} = 13640 \text{ far.} = £14 \; 4s \; 2d.$$

(8)...
$$£ \quad s. \quad d.$$
$$435 \quad 11 \quad 1 \text{ amount}$$
$$372 \quad 13 \quad 4 \text{ principal}$$
$$\overline{£62 \quad 17 \quad 9} \text{ int. for } 4\tfrac{1}{2} \text{ years}$$

$£62 \; 17s. \; 9d. \div 4\tfrac{1}{2} = £13 \; 19s. \; 6d.$ int. for 1 year

| £ s. d. | | £ s. d. | | £ | | £ |
|---|---|---|---|---|---|---|
| 372 13 4 | : | 13 19 6 | :: | 100 | : | 3¾ per cent. |

(9) ..

$$5 \text{ per cent.} = \tfrac{1}{20} \overline{\Big| \begin{array}{cc} \pounds & s. \\ 135 & 0 \end{array}}$$
$$73 \text{ da.} = \tfrac{1}{5} \text{ year} \overline{\Big| \begin{array}{cc} 6 & 15 \end{array}} \text{ int. for 1 year}$$
$$\overline{\pounds 1 \quad 7s.} \text{ int. for 73 days}$$

Amount of £100 in 73 days, at 5 per cent. per annum

$$= \pounds 100 + (\pounds 5 \times \tfrac{1}{5}) = \pounds 100 + \pounds 1 = \pounds 101$$

$$\overset{\pounds}{101} \; : \; \overset{\pounds}{135} \; :: \; \overset{\pounds}{1} \; : \; \overset{\pounds}{1} \; \overset{s.}{6} \; \overset{d.}{8\tfrac{80}{101}}$$

$$
\begin{array}{rcccc}
 & & \pounds & s. & d. \\
\text{Interest, or } bank \text{ discount} = & & 1 & 7 & 0 \\
\text{true discount} = & & 1 & 6 & 8\tfrac{80}{101} \\
\text{difference} = & & & & \overline{3\tfrac{21}{101}d.}
\end{array}
$$

(10)...

$$\sqrt[3]{1715} - \sqrt[3]{2560} + \sqrt[3]{3645} - \sqrt[3]{135}$$
$$= \sqrt[3]{343 \times 5} - \sqrt[3]{512 \times 5} + \sqrt[3]{729 \times 5} - \sqrt[3]{27 \times 5}$$
$$= 7\sqrt[3]{5} - 8\sqrt[3]{5} + 9\sqrt[3]{5} - 3\sqrt[3]{5}$$
$$= 5\sqrt[3]{5}$$

## EXERCISE CXXVI.

(1)...

1.
$$\tfrac{5}{7} \; : \; \tfrac{9}{11} \; :: \; \tfrac{11}{14} \; : \; x$$
$$x = \frac{7}{5} \times \frac{9}{11} \times \frac{11}{\underset{2}{14}} = \frac{9}{10}$$

2.
$$3\tfrac{1}{5} \; : \; 4\tfrac{2}{5} \; :: \; 17\tfrac{3}{5} \; : \; x$$
$$x = \frac{\overset{}{5}}{\underset{\underset{2}{2}}{16}} \times \frac{\overset{19}{38}}{9} \times \frac{\overset{11}{88}}{5} = \frac{209}{9} = 23\tfrac{2}{9}$$

3.     ·625  :  ·745  ::  ·6875
                  1·1        1·1
                 ‾‾‾‾‾
                 ·8195

4.     2·05  :  7·025  ::  6·355
                  3·1         3·1
                ‾‾‾‾‾
                 7025
                21075
               ‾‾‾‾‾‾‾
               21·7775

(2)...     (137 ft. 6 in. × 39 ft. 5 in.) ÷ 35 ft. 10 in.

= (1650 in. × 473 in.) ÷ 430 in.

= 780450 sq. in. ÷ 430 in.

= 1815 in. = 151 ft. 3 in.

(3)...
    ac.
·09375 = 15 perches
   4
‾‾‾‾‾‾‾
·37500
  40
‾‾‾‾‾‾‾
15·00000 per.

    ro.
·825 = 33 perches
  40
‾‾‾‾‾‾‾
33·000 per.

33 per. − 15 per. = 18 perches

(4)...
$$\cdot 41666 \text{ \&c.} = \frac{416-41}{900} = \frac{375}{900} = \frac{5}{12}$$

$\frac{5}{12}$ of £1 = 8s. 4d.

(5)...
men da.     men da.     £       £
5 × 6   :   7 × 8  ::   7   :   $x$

$$x = \frac{7 \times \overset{4}{\cancel{8}} \times 7}{\times \underset{3}{\cancel{6}}} = £\frac{196}{15} = £13 \text{ 1s. } 4d.$$

(6)...
$$\begin{array}{c} \text{men da.} \\ 12\times 7 \end{array} \; : \; \begin{array}{c} \text{wo. da.} \\ 15\times x\times \frac{3}{5} \end{array} \; :: \; \begin{array}{c} \pounds \\ 10\frac{1}{2} \end{array} \; : \; \begin{array}{c} \pounds \\ 9 \end{array}$$

$$x = (12\times 7\times 9)\div(15\times \tfrac{3}{5}\times 10\tfrac{1}{2})$$

$$x = \frac{\overset{4}{\cancel{12}}}{1}\times\frac{7}{1}\times\frac{\overset{3}{\cancel{9}}}{1}\times\frac{1}{\underset{3}{\cancel{15}}}\times\frac{\cancel{5}}{3}\times\frac{2}{\underset{3}{\cancel{21}}} = 8 \text{ days}$$

(7)...$61\cdot 8\,\text{lb.}=61\frac{4}{5}\,\text{lb.}$  $\pounds 1\cdot 2875=\pounds 1\frac{23}{80}$  $5\cdot 546875\,\text{cwt.}=621\frac{1}{4}\,\text{lb.}$

$$\begin{array}{c} \text{lb.} \\ 61\frac{4}{5} \end{array} \; : \; \begin{array}{c} \text{lb.} \\ 621\frac{1}{4} \end{array} \; :: \; \begin{array}{c} \pounds \\ 1\frac{23}{80} \end{array} \; : \; x$$

$$x = \frac{\cancel{5}}{\underset{3}{\cancel{309}}}\times\frac{2485}{4}\times\frac{\overset{}{\cancel{103}}}{\underset{16}{\cancel{80}}} = \pounds\frac{2485}{192} = \pounds 12\ 18s.\ 10\tfrac{1}{4}d.$$

(8)...Amount of $\pounds 100$ in 8 mo. at $4\frac{1}{2}$ per cent. per annum
$$= \pounds 100 + (\pounds 4\tfrac{1}{2}\times\tfrac{2}{3}) = \pounds 103$$

$$\begin{array}{c} \pounds \\ 103 \end{array} \; : \; \begin{array}{c} \pounds \\ 450 \end{array} \; :: \; \begin{array}{c} \pounds \\ 100 \end{array} \; : \; x$$

$$x = \frac{450\times 100}{103} = \pounds\frac{45000}{103} = \pounds 436\ 17s.\ 10\tfrac{38}{103}d.$$

(9)...    $8\frac{1}{2}d.$ per lb. $= \pounds 3\ 19s.\ 4d.$ per cwt.

$$125\frac{25}{27} \; : \; 100 \; :: \; \begin{array}{ccc} \pounds & s. & d. \\ 3 & 19 & 4 \end{array} = 3\frac{29}{30} \; : \; x$$

$$x = \frac{\overset{9}{\cancel{27}}}{\underset{\underset{2}{\cancel{34}}}{\cancel{3400}}}+\frac{\cancel{100}}{1}+\frac{\overset{7}{\cancel{119}}}{\underset{10}{\cancel{30}}} = \pounds\frac{63}{20} = \pounds 3\ 3s.\ \text{per cwt.}$$

(10)...                 $5\overset{.}{4}2\overset{.}{9}4\overset{.}{0}9\overset{.}{3}7\overset{.}{1}8\overset{.}{4}4\overset{.}{6}7\overset{.}{6}(73684526$
                        49
          143) $\overline{529}$
                429
          1466) $\overline{10040}$
                 8796
        14728) $\overline{124493}$
                117824
       147364) $\overline{666971}$
                589456
      1473685) $\overline{7751584}$
                7368425
     14736902) $\overline{38315946}$
                29473804
    147369046) $\overline{884214276}$
                 884214276

                $4\overset{.}{3}7\overset{.}{2}4\overset{.}{5}4\overset{.}{7}9(759$
                343
$7^2 \times 300 = 14700)\ \overline{94245}$
                $\overline{73500} = 14700 \times 5$
                $5250 = 7 \times 30 \times 5^2$
                $125 = 5^3$
                $\overline{78875}$ subtrahend
$75^2 \times 300 = 1687500)\overline{15370479}$
                $\overline{15187500} = 1687500 \times 9$
                $182250 = 75 \times 30 \times 9^2$
                $729 = 9^3$
                $\overline{15370479}$


## EXERCISE CXXVII.

(1)... 1     $\left(\frac{4}{5} + \frac{3}{4} - \frac{2}{3}\right) - \left(\frac{2}{9} - \frac{1}{3} + \frac{4}{5}\right)$

$= \left(\dfrac{48 + 45 - 40}{60}\right) - \left(\dfrac{10 - 15 + 36}{45}\right)$

$= \frac{53}{60} - \frac{31}{45} = \frac{159}{180} - \frac{124}{180} = \frac{35}{180} = \frac{7}{36}$

2. $\quad (2\frac{3}{5} - 1\frac{7}{8} + 3\frac{1}{4}) \times (6\frac{2}{3} + 4\frac{4}{5} - 2\frac{2}{9})$

$= (2\frac{24}{40} - 1\frac{35}{40} + 3\frac{10}{40}) \times (6\frac{30}{45} + 4\frac{36}{45} - 2\frac{10}{45})$

$= 3\frac{39}{40} \times 9\frac{11}{45} = \dfrac{\overset{53}{159}}{\underset{5}{40}} \times \dfrac{\overset{52}{416}}{\underset{15}{45}} = \dfrac{2756}{75} = 36\frac{56}{75}$

3. $\quad \dfrac{6\frac{2}{3} - 4\frac{4}{5}}{5\frac{2}{3} + 3\frac{1}{3}} + \dfrac{7}{9} = \dfrac{6\frac{10}{15} - 4\frac{12}{15}}{5\frac{9}{15} + 3\frac{5}{15}} \div \dfrac{7}{9}$

$= \dfrac{1\frac{13}{15}}{8\frac{14}{15}} \div \dfrac{7}{9} = \dfrac{\overset{2}{14}}{67} \times \dfrac{9}{7} = \dfrac{18}{67}$

(2)...
$\dfrac{11}{16}$ gui. $= \dfrac{11}{16} \times \dfrac{21}{1} = \dfrac{231}{16} = \qquad \overset{s.}{14} \quad \overset{d.}{5\frac{1}{4}}$

$\dfrac{17}{24}$ sov. $= \dfrac{17}{\underset{6}{24}} \times \dfrac{\overset{5}{20}}{1} = \dfrac{85}{6} = \qquad 14 \quad 2$

$\dfrac{9}{10}$ cr. $= \dfrac{9}{\underset{2}{10}} \times \dfrac{5}{1} = \dfrac{9}{2} = \qquad 4 \quad 6$

$\dfrac{13}{16}$ fl. $= \dfrac{13}{\underset{8}{16}} \times \dfrac{2}{1} = \dfrac{13}{8} = \qquad 1 \quad 7\frac{1}{2}$

$\dfrac{19}{24} = \qquad 9\frac{1}{2}$

£1  15  6¼

(3)...
7 hrs. 25 min. = 445 minutes
1 day = 1440 ,,
$\frac{445}{1440} \div \frac{5}{5} = \frac{89}{288}$ of a day

4 da. 8 hrs. 40 min. = 6280 minutes
1 week = 10080 ,,
$\frac{6280}{10080} \div \frac{40}{40} = \frac{157}{252}$ of a week

(4)...      8s. 1½d. = $£\frac{13}{32}$        £25 17s. 8½d. = $£25\frac{85}{96}$

$$\frac{£}{\frac{13}{32}} \quad : \quad \frac{£}{25\frac{85}{96}} \quad :: \quad \overset{\text{lb.}}{19\tfrac{1}{2}} \quad : \quad x$$

$$x = \frac{32}{13} \times \frac{2485}{96} \times \frac{39}{2} = \frac{2485}{2} \text{ lb.} = 11 \text{ cwt. } 10\tfrac{1}{2} \text{ lb.}$$

(5)...                2500 guineas = £2625

$$\frac{49}{200} \times \frac{2625}{1} = £\frac{5145}{8} = £643 \quad 2s. \; 6d. \quad \text{Eldest}$$

$$\frac{7}{32} \times \frac{2625}{1} = £\frac{18375}{32} = £574 \quad 4s. \; 4\tfrac{1}{2}d. \quad \text{Second}$$

$$\frac{29}{100} \times \frac{2625}{1} = £\frac{15225}{32} = £475 \; 15s. \; 7\tfrac{1}{2}d. \quad \text{Third}$$

$$\frac{9}{50} \times \frac{2625}{1} = £\frac{945}{2} = £472 \; 10s. \; 0d. \quad \text{Fourth}$$

The four elder brothers receive $\overline{£2165 \; 12s. \; 6d.}$

$£2625 - £2165 \; 12s. \; 6d. = £459 \; 7s. \; 6d.$   Youngest

(6)...
$$\overset{\text{cwt. mi.}}{\tfrac{7}{16}\times 50} \quad : \quad \overset{\text{cwt. mi.}}{3\tfrac{9}{32}\times 125} \quad :: \quad \overset{£}{\tfrac{7}{60}} \quad : \quad x$$

$$x = (3\tfrac{9}{32} \times 125 \times \tfrac{7}{60}) \div (\tfrac{7}{16} \times 50)$$

$$= \frac{105}{32} \times \frac{125}{1} \times \frac{7}{60} \times \frac{16}{7} \times \frac{1}{50}$$

$$= £\frac{35}{16} = £2 \; 3s. \; 9d.$$

(7)... £100−£6½ = £93¾,  cost price of £100 share

£100+£8¼ = £108¼, selling  „  „

$$\begin{array}{ccccccc} £ & & £ & & £ & & £ \\ 93\tfrac{3}{4} & : & 108\tfrac{1}{4} & :: & 1125 & : & 1299 \end{array}$$

gain = £1299−£1125 = £174

$$\begin{array}{lcccccc} & & & s. & d. & & s. & d. \\ 10 \text{ lb. at} & 3 & 0 & \text{per lb.} & = & 30 & 0 \\ 8 \text{ „ „} & 3 & 9 & \text{„} & = & 30 & 0 \\ 6 \text{ „ „} & 4 & 3 & \text{„} & = & 25 & 6 \end{array}$$

(8)...

24    cost                 85s. 6d.

24 lb. at 4s. per lb. = 96s.

profit, 96s.−85s. 6d. = 10s. 6d.

$$\begin{array}{ccccccccc} s. & d. & & s. & d. \\ 85 & 6 & : & 10 & 6 & :: & 100 & : & 12\tfrac{16}{17} \text{ per cent.} \end{array}$$

(9)...

$$\begin{array}{rcr} £ & & \text{mo.} \\ 150 \times 2 & = & 300 \\ 210 \times 6 & = & 1260 \\ 120 \times 7 & = & 840 \\ \hline 480 & & 2400 \end{array}$$

2400÷480 = 5 months*

(10)...

$$52 \; : \; x \; :: \; x \; : \; 117$$

$$x^2 = 52 \times 117$$

$$= 6084$$

$$\therefore \; x = 78$$

$$68 \; : \; x \; :: \; x \; : \; 153$$

$$x^2 = 68 \times 153$$

$$= 10404$$

$$\therefore \; x = 102$$

* The above answer is sufficiently accurate for all practical purposes : if interest, *say*, at 5 per cent. per annum, were reckoned, the equated time would be about *half a day* less than 5 months.

x

### *EXERCISE CXXVIII.*

(1)...    $\dfrac{11}{15} \times 3\frac{1}{8} \times \dfrac{1\frac{3}{4}}{7\frac{1}{2}} \times 1\frac{4}{11} \times 2 \times 6\frac{2}{5} \times \dfrac{4}{\frac{4}{4}} \times 3\frac{3}{4} \times 2\frac{1}{7} \times \dfrac{\frac{3}{7}}{1\frac{1}{7}}$

$$= \dfrac{11}{15} \times \dfrac{25}{8} \times \dfrac{7}{30} \times \dfrac{15}{11} \times \dfrac{2}{1} \times \dfrac{32}{5} \times \dfrac{1}{5} \times \dfrac{15}{4} \times \dfrac{15}{7} \times \dfrac{1}{4} = 4$$

(2)...1.      $(3\frac{4}{5} \text{ of } 3\frac{1}{3} \text{ of } 7) \div (8\frac{3}{4} \text{ of } 6\frac{1}{3} \text{ of } 1\frac{3}{5})$

$$= \dfrac{19}{5} \times \dfrac{10}{3} \times \dfrac{7}{1} \times \dfrac{4}{35} \times \dfrac{3}{19} \times \dfrac{5}{8} = 1$$

2.   $\left( \dfrac{8}{10\frac{2}{7}} + \dfrac{6\frac{2}{3}}{8} - \dfrac{5\frac{5}{7}}{13\frac{5}{7}} \right) \div 7\frac{1}{5}$

$$= (\tfrac{7}{9} + \tfrac{5}{6} - \tfrac{5}{12}) \div 7\frac{1}{5}$$

$$= \dfrac{28 + 30 - 15}{36} \div 7\frac{1}{5} = \dfrac{43}{36} \times \dfrac{5}{36} = \dfrac{215}{1296}$$

(3)...

```
         4) 3
       28)15·75
        4) 2·5625
```
2 qrs. 15¾ lb. = ·640625 of a cwt.

```
          min.
        60)15
        24)20·25
         7) 2·84375
```
2 da. 20 hrs. 15 min. = ·40625 of a week

```
          8) 1
30¼ = 30·25)15·125
       40)27·5
        4) 1·6875
```
1 ro. 27 per. 15½ yds. = ·421875 of an acre

(4)...
$$84 \text{ gallons of rum}$$
$$16$$
$$14)\overline{1344}$$
$$\overline{96} \text{ gallons of rum and water}$$
$$84$$
$$\overline{12} \text{ gallons of water}$$

(5)...

| min. | | hrs. | | min. | | gal. |
|---|---|---|---|---|---|---|
| 5 | : | $2\frac{1}{4}$ | = | $135$ | :: | 7 |

$$27$$
$$7$$
$$\text{capacity of cistern} = \overline{189} \text{ gallons}$$

(6)...
$$5\tfrac{3}{4}+3\tfrac{2}{3} = 5\tfrac{9}{12}+3\tfrac{8}{12} = 9\tfrac{5}{12}$$

$$£4117 \ 8s. \ 9d. = £4117\tfrac{7}{16}$$

$$9\tfrac{5}{12} \quad : \quad 5\tfrac{3}{4} \quad :: \quad £4117\tfrac{7}{16} \quad : \quad x$$

$$x = \frac{\cancel{12}^{\,3}}{\cancel{113}}\times\frac{23}{\cancel{4}}\times\frac{\cancel{65879}^{\,583}}{16} = £\frac{40227}{16} = £2514 \ 3s. \ 9d.$$

| | £ | s. | d. |
|---|---|---|---|
| Value of property left | 4117 | 8 | 9 |
| Wife's portion | 2514 | 3 | 9 |
| Daughter's portion | 1603 | 5 | 0 |

(7)...
$$\text{Area of floor} = 26\tfrac{1}{4} \text{ ft.} \times 15\tfrac{3}{4} \text{ ft.}$$

$$\text{Area of 1 yd. matting} = 3\text{ft.} \times 2\cdot625 \text{ ft.} = 3 \text{ ft.} \times 2\tfrac{5}{8} \text{ ft.}$$

$$\text{Matting required, } (26\tfrac{1}{4}\times15\tfrac{3}{4})\div(3\times2\tfrac{5}{8})$$

$$= \frac{105}{\cancel{4}}\times\frac{\cancel{63}^{\,3}}{\cancel{4}_{2}}\times\frac{1}{\cancel{3}}\times\frac{\cancel{8}^{\,7}}{\cancel{21}} = \frac{105}{2} = 52\tfrac{1}{2} \text{ yards.}$$

x 2

(8)... From 9 A.M. on Friday to 5 P.M. on the following
Wednesday = 128 hours

$$\overset{\text{hrs.}}{24} \quad : \quad \overset{\text{hrs.}}{128} \quad :: \quad \overset{\text{hr.}}{\tfrac{3}{80}} \quad : \quad x$$

$$x = \frac{1}{\underset{3}{\cancel{24}}} \times \frac{\overset{8}{\cancel{128}}}{1} \times \frac{\cancel{3}}{\underset{5}{\cancel{80}}} = \tfrac{1}{5} \text{ hour} = 12 \text{ minutes}$$

(9)... 4 per cent. = $\frac{1}{25}$

$\frac{1}{2}$  ,,  = $\frac{1}{8}$

6 mo. = $\frac{1}{2}$ of 1 yr.

2 mo. = $\frac{1}{3}$ of 6 mo.

|   | £ | s. | d. |   |
|---|---|----|----|---|
|   | 225 | 16 | 8 |   |
|   | 9 | 0 | 8 |   |
|   | 1 | 2 | 7 |   |
|   | 10 | 3 | 3 | interest for 1 year |
|   | 5 | 1 | 7$\frac{1}{2}$ |   |
|   | 1 | 13 | 10$\frac{1}{2}$ |   |
|   | £16 | 18 | 9 | int. for 1 yr. 8 mo. |

(10)...      $\overset{£}{71\frac{1}{4}}$  :  $\overset{£}{3000}$  ::  $\overset{£}{4}$  :  required income

$$\text{required income} = \frac{4}{\underset{19}{\cancel{285}}} \times \frac{\overset{200}{\cancel{3000}}}{1} \times \frac{4}{1} = £\frac{3200}{19} = £168 \text{ 8s. } 5\tfrac{1}{19}d.$$

## EXERCISE CXXIX.

(1)...

|   |   |   | s. | d. | £ | s. | d. |
|---|---|---|----|----|---|----|----|
| 347$\frac{1}{2}$ | yds. | Calico ............... | 0 | 8$\frac{1}{2}$ | = 12 | 6 | 1$\frac{3}{4}$ |
| 279$\frac{3}{4}$ | ,, | do. ............... | 0 | 10 | = 11 | 13 | 1$\frac{1}{2}$ |
| 265$\frac{1}{2}$ | ,, | Irish Linen ......... | 1 | 7 | = 21 | 0 | 4$\frac{1}{2}$ |
| 149$\frac{1}{4}$ | ,, | Flannel ............ | 1 | 5 | = 10 | 11 | 5$\frac{1}{4}$ |
| 94$\frac{3}{4}$ | ,, | Linen Sheeting ... | 2 | 2 | = 10 | 5 | 3$\frac{1}{4}$ |
|   |   |   |   |   | £65 | 16 | 4$\frac{1}{2}$ |

(2)...

$$\frac{7\frac{5}{9}}{9\frac{11}{12}} = \frac{\frac{68}{9}}{\frac{119}{12}} = \frac{\overset{4}{\cancel{68}} \times \overset{4}{\cancel{12}}}{\cancel{119} \times \cancel{9}} = \frac{16}{21}$$
$$\phantom{\frac{7\frac{5}{9}}{9\frac{11}{12}}} \quad 7 \quad 3$$

$$\frac{8\frac{1}{10}}{14\frac{2}{5}} = \frac{\frac{81}{10}}{\frac{72}{5}} = \frac{\overset{9}{\cancel{81}} \times \cancel{5}}{\cancel{72} \times \cancel{10}} = \frac{9}{16}$$
$$\phantom{\frac{8\frac{1}{10}}{14\frac{2}{5}}} \quad 8 \quad 2$$

$$\frac{9}{16} \text{ of } 20 \text{ sov.} = \frac{9}{\cancel{16}} \times \frac{\overset{5}{\cancel{20}}}{1} = \frac{45}{4} = \overset{\pounds}{11} \quad \overset{s.}{5} \quad \overset{d.}{0}$$
$$\phantom{xxxxx} 4$$

$$\frac{16}{21} \text{ of } 7\frac{1}{2} \text{ gui.} = \frac{\overset{2}{\cancel{16}}}{\cancel{21}} \times \frac{\overset{3}{\cancel{63}}}{\cancel{8}} = 6 = \quad 6 \quad 0 \quad 0$$
$$\phantom{xxxxxxxxxxxxxxxxxxxxxxxx} \overline{\pounds 5 \quad 5 \quad 0}$$

(3)...

$$\text{Let } x = \cdot 392708333 \text{ \&c.}$$
$$\text{then } 10000000\,x = 3927083\cdot 33 \text{ \&c.}$$
$$\text{and } \phantom{x}1000000\,x = \phantom{x}392708\cdot 33 \text{ \&c.}$$
$$\overline{\phantom{x}9000000\,x = 3534375}$$

$$x = \tfrac{3534375}{9000000} = \tfrac{377}{960}$$

$$\frac{377}{960} \text{ of } \pounds 1 = \frac{377}{\cancel{960}} \times \frac{\cancel{20}}{1} = \frac{377}{48}s. = 7s. \ 10\tfrac{1}{4}d.$$
$$\phantom{xxxxx} 48$$

(4)... $44\frac{2}{5}$ E. ells $= 55\frac{1}{2}$ yds. $\phantom{xxx}$ 178·875 yds. $= 178\frac{7}{8}$ yds.

$$\overset{\text{yds.}}{55\tfrac{1}{2}} \ : \ \overset{\text{yds.}}{178\tfrac{7}{8}} \ :: \ \overset{\pounds}{6\tfrac{5}{16}} \ : \ x$$

$$x = \frac{\cancel{7}}{\cancel{111}} \times \frac{1431}{\underset{4}{\cancel{8}}} \times \frac{\cancel{111}}{16} = \pounds \frac{1431}{16} = \pounds 22 \ 7s. \ 2\tfrac{1}{4}d.$$

(5)...
$$\text{A can do } \tfrac{4}{21} \text{ in 1 day}$$
$$\text{B } \quad ,, \quad \tfrac{4}{25} \quad ,,$$
$$\text{C } \quad ,, \quad \tfrac{1}{7} \quad ,,$$
$$\text{D } \quad ,, \quad \tfrac{4}{35} \quad ,,$$

A+B+C+D can do $\tfrac{4}{21}+\tfrac{4}{25}+\tfrac{1}{7}+\tfrac{4}{35}$ in 1 day

$$\frac{4}{21}+\frac{4}{25}+\frac{1}{7}+\frac{4}{35} = \frac{100+84+75+60}{525} = \frac{319}{525}$$

$$\overset{\text{day}}{\phantom{x}} \qquad \overset{\text{days}}{\phantom{x}}$$
$$\tfrac{319}{525} \; : \; 1 \; :: \; 1 \; : \; x$$
$$x = \tfrac{525}{319} = 1\tfrac{206}{319} \text{ days}$$

(6)...
$$1°\ 27'\ \text{E.}$$
$$5°\ 47'\ \text{W.}$$
Difference of longitude $= \overline{7°\ 14'}$

$$1° \; : \; 7°\ 14' \; :: \; \overset{\text{min.}}{4} \; : \; 28 \text{ min. } 56 \text{ sec.}$$

i.e. the time at the North Foreland is 28 min. 56 sec. *in advance of* that at the Land's End.

(7)...
$$2°\ 54'\ \text{W.}$$
$$57°\ 28'\ \text{E.}$$
Difference of longitude $= \overline{60°\ 22'}$

$$1° \; : \; 60°\ 22' \; :: \; \overset{\text{min.}}{4} \; : \; 4 \text{ hrs. } 1 \text{ min. } 28 \text{ sec.}$$

Time at Chester     6 hrs. 30 min.   0 sec. A.M.
Difference of time    4 hrs.   1 min. 28 sec.
Time at Port Louis $\overline{10 \text{ hrs. } 31 \text{ min. } 28 \text{ sec. A.M.}}$

(8)...
Sum of squares $= 1189000$
$$678^2 = \phantom{0}459684$$
Square of greater no. $= \overline{729316}(854$
$$\phantom{=======}64$$
$$165)\overline{\phantom{0}893}$$
$$\phantom{=====}825$$
$$1704)\overline{\phantom{0}6816}$$
$$\phantom{======}6816$$

The greater number is 854

(9)...       Greater number = $\sqrt{319225}$ = 565

$$565^3 = 180362125$$
$$\text{difference} = 102507642$$

$$\text{cube of less no.} = \overline{77854483}(42^7$$

$$\begin{array}{r} 64 \\ \hline \end{array}$$

$$4^2 \times 300 = 4800\overline{)13854}$$

$$\begin{array}{r} 9600 = 4800 \times 2 \\ 480 = 4 \times 30 \times 2^2 \\ 8 = 2^3 \\ \hline 10088 \text{ subtrahend} \end{array}$$

$$42^2 \times 300 = 529200\overline{)\,3766483}$$

$$\begin{array}{r} 3704400 = 529200 \times 7 \\ 61740 = 42 \times 30 \times 7^2 \\ 343 = 7^3 \\ \hline 3766483 \end{array}$$

(10)...  For £104 worth, at the *retail* price, he pays £75, thus gaining £29

$$\begin{array}{ccccccc} £ & & £ & & & & \\ 104 & : & 29 & :: & 100 & : & x \end{array}$$

$$x = \frac{29 \times \cancel{100}^{25}}{\cancel{104}_{26}} = \frac{725}{26} = 27\tfrac{23}{26} \text{ per cent. out of receipts}$$

To find the gain per cent. on the *outlay* :—

$$\begin{array}{ccccccc} £ & & £ & & & & \\ 75 & : & 29 & :: & 100 & : & x \end{array}$$

$$x = \frac{29 \times \cancel{100}^{4}}{\cancel{75}_{3}} = \frac{116}{3} = 38\tfrac{2}{3} \text{ per cent.}$$

## EXERCISE CXXX.

(1)... The gentleman had walked $(3\frac{1}{2} \times 1\frac{1}{2} =)$ $5\frac{1}{4}$ miles, when his servant started from Warrington

$$20 \text{ miles} - 5\frac{1}{4} \text{ miles} = 14\frac{3}{4} \text{ miles}$$

They met in $\{14\frac{3}{4} \div (3\frac{1}{2} + 7\frac{1}{2}) =\}$ $1\frac{15}{44}$ hours after the servant started

$$3\frac{1}{2} \times 1\frac{15}{44} = \frac{7}{2} \times \frac{59}{44} = \frac{413}{88} = 4\frac{61}{88} \text{ miles}$$

$$5\frac{1}{4} \text{ mi.} + 4\frac{61}{88} \text{ mi.} = 9\frac{83}{88} \text{ miles} = 9 \text{ mi. 7 fur. 120 yds.}$$

(2)...1.  1 qr. 1 na. $= \frac{1}{4}$ of 1 ell

|     |  s. |  d. |            |
|-----|-----|-----|------------|
|     | 11  | 3   | per ell    |
|     |     |     | $6 \times 12 + 3 = 75$ |
|     | 3   | 7   | 6 |
|     |     |     | 12 |
|  40 | 10  | 0   |  |
|   1 | 13  | 9   |  |
|     | 2   | $9\frac{3}{4}$ |  |
|     | 1   | $1\frac{1}{2}$ |  |
| £42 | 7   | $8\frac{1}{4}$ |  |

2 na. $= \frac{1}{10}$ of 1 ell

2.  576 cu. in. $= \frac{1}{3}$ of 1 cu. ft.

|    |  s. |  d. |              |
|----|-----|-----|--------------|
|    | 4   | 6   | per cubic foot |
|    |     |     | $4 \times 9 + 3 = 39$ |
|    | 18  | 0   |  |
|    |     | 9   |  |
|  8 | 2   | 0   |  |
|    | 13  | 6   |  |
|    | 1   | 6   |  |
|    |     | 6   |  |
|    |     | $2\frac{1}{4}$ |  |
| £8 | 17  | $8\frac{1}{4}$ |  |

192  „  $= \frac{1}{3}$ of 576 in.

72  „  $= \frac{1}{8}$ of 576 in.

$$
\begin{array}{llll}
 & \pounds & s. & d. \\
3. & 13 & 10 & 0 \text{ per ton} \\
\end{array}
$$

$$4 \times 4 + 1 = 17$$

$$
\begin{array}{rrr}
\overline{54} & 0 & 0 \\
& & 4 \\
\hline
216 & 0 & 0
\end{array}
$$

| | | £ | s. | d. |
|---|---|---|---|---|
| 5 cwt. | = ¼ of 1 ton | 13 | 10 | 0 |
| 2 qrs. | = $\frac{1}{10}$ of 5 cwt. | 3 | 7 | 6 |
| 1 qr. | = ½ of 2 qrs. | | 6 | 9 |
| 14 lb. | = ½ of 1 qr. | | 3 | 4½ |
| | | | 1 | 8¼ |
| | £233 | 9 | 3¾ | |

(3)... 5 acres, 3 roods, 20 perches = 28435 sq. yards

242 yards × 220 yards = 53240 „

$$
\begin{array}{cccc}
\text{sq. yds.} & \text{sq. yds.} & \text{qrs. bu. pks.} & \text{pks.} \\
28435 & : \ \ 53240 & :: \ \ 26\ 3\ 2 = 846 & : \ \ x
\end{array}
$$

$$x = \frac{\cancel{53240} \times \cancel{846}}{\cancel{28435}} = 1584 \text{ pks.} = 49 \text{ qrs. 4 bu.}$$

(4)... $\quad 3\tfrac{7}{16} \ : \ 24{\cdot}75 = 24\tfrac{3}{4} \ :: \ 9\tfrac{7}{8} \ : \ x$

$$x = \frac{\cancel{16}}{\cancel{55}} \times \frac{\cancel{99}}{\cancel{4}} \times \frac{79}{8} = \frac{711}{10} = 71\tfrac{1}{10} = 71{\cdot}1$$

$$3\tfrac{3}{5} \ : \ x \ :: \ x \ : \ 57\tfrac{3}{5}$$

$$x^2 = 3\tfrac{3}{5} \times 57\tfrac{3}{5}$$

$$= \tfrac{18}{5} \times \tfrac{288}{5}$$

$$= \tfrac{5184}{25}$$

$$\therefore x = \tfrac{72}{5} = 14\tfrac{2}{5}$$

(5)...     $\cdot 533$ &c. $= \dfrac{53-5}{90} = \dfrac{48}{90} = \dfrac{8}{15}$     $\cdot 444$ &c $= \dfrac{4}{9}$

$$\dfrac{8}{15} \text{ sov.} = \dfrac{8}{\underset{3}{\cancel{15}}} \times \dfrac{\overset{4}{\cancel{20}}}{1} = \dfrac{\overset{s.}{32}}{3} = \overset{s. \; d.}{10 \; 8}$$

$$\dfrac{4}{9} \text{ gui.} = \dfrac{4}{\underset{3}{\cancel{9}}} \times \dfrac{\overset{7}{\cancel{21}}}{1} = \dfrac{28}{3} = \dfrac{9 \quad 4}{\text{£}1 \; 0 \; 0}$$

(6)...                    $5\frac{1}{4} + 3\frac{3}{4} + 2\frac{3}{4} = 11\frac{3}{4}$

$11\frac{3}{4}$  :  $5\frac{1}{4}$  :: $\overset{\text{£}}{5640}$  :  £2520, wife's share

$11\frac{3}{4}$  :  $3\frac{3}{4}$  :: $\overset{\text{£}}{5640}$  :  £1800, son's share

$11\frac{3}{4}$  :  $2\frac{3}{4}$  :: $\overset{\text{£}}{5640}$  :  £1320, daughter's share

(7)...  .            A + B + C scored 52 runs
                     B + C    „    39   „
             ∴   A          „    13   „

                     A + B + C scored 52 runs
                     A    + C    „    35   „
             ∴   B          „    17   „

             ∴  C scored $52 - (13 + 17) = 22$ runs

(8)...          $75\frac{3}{11}$ lb. at $16\frac{1}{2}d.$ per lb. $= \overset{\text{£} \quad s. \quad d.}{5 \quad 3 \quad 6}$
                              cost $= 4 \quad 6 \quad 3$
                              profit $= \overline{\quad 17s. \; 3d.}$

$\overset{\text{£} \; s. \; d.}{4 \; 6 \; 3}$  : $\overset{s. \; d.}{17 \; 3}$  ::  100  :  20 per cent.

(9)...In the solution of questions in Arithmetical Progression the following notation will be used :

$$a = \text{the first term}$$
$$d = \text{the common difference}$$
$$l = \text{the last term}$$
$$m = \text{the number of means}$$
$$n = \text{the number of terms}$$
$$s = \text{the sum of the series}$$

1.

$$\text{Sum of series} = \{2a + (n-1)d\}\frac{n}{2}$$

$$= \{6 + (22 \times 4)\} \tfrac{23}{2}$$

$$= 94 \times \tfrac{23}{2}$$

$$= 1081$$

2.

$$\text{Sum} = \{2a + (n-1)d\}\frac{n}{2}$$

$$= \{4 + (34 \times 1\tfrac{1}{2})\} \tfrac{35}{2}$$

$$= 55 \times \tfrac{35}{2}$$

$$= 962\tfrac{1}{2}$$

3.

$$\text{Sum} = \{2a + (n-1)d\}\frac{n}{2}$$

$$= \{\tfrac{5}{4} + (29 \times \tfrac{1}{2})\} 15$$

$$= 15\tfrac{3}{4} \times 15$$

$$= 236\tfrac{1}{4}$$

(10)...  Common difference $= \dfrac{l-a}{m+1} = \dfrac{29-5}{7+1} = 3$

hence the means are 8, 11, 14, 17, 20, 23, 26

## EXERCISE CXXXI.

(1)...
$$\frac{7}{12} + 5\frac{2}{3} + \frac{2\frac{3}{4}}{7} + \frac{5\frac{1}{4}}{7\frac{7}{10}}$$

$$= \tfrac{7}{12} + \tfrac{47}{9} + \tfrac{11}{28} + \tfrac{15}{22}$$

$$= \frac{1617 + 14476 + 1089 + 1890}{2772}$$

$$= \tfrac{19072}{2772} = \tfrac{4768}{693} = 6\tfrac{610}{693}, \text{ sum}$$

$$13\tfrac{5}{28} - 6\tfrac{610}{693} = 13\tfrac{495}{2772} - 6\tfrac{2440}{2772} = 6\tfrac{827}{2772}, \text{ difference}$$

(2)...
$$8) 1$$
$$30\tfrac{1}{4} = 30\cdot25)\overline{15\cdot125}$$
$$40)\overline{17\cdot5}$$
$$4)\ \overline{3\cdot4375}$$

3 ro. 17 per. 15½ yds. $= \quad \overline{\cdot859375}$ of an acre

$$\frac{19}{50} \text{ sq. mile} = \frac{19}{\cancel{50}} \times \frac{\overset{64}{\cancel{640}}}{1} = \frac{1216}{5} \text{ ac.} = 243 \text{ acres, 32 perches}$$

(3)...

| | car. | | car. | | £ | s. | d. |
|---|---|---|---|---|---|---|---|
| | $\cancel{22}$ | : | $\cancel{24}$ | :: | 3 | 17 | $10\frac{1}{2}$ |
| | 11 | | 12 | | | | 12 |

$$11)\overline{46\ 14\ \ 6}$$
$$\overline{£4\ \ 4\ \ 11\tfrac{5}{11}}$$

(4)...

| | oz. | | oz. | dwts. | | oz. | dwts. | | |
|---|---|---|---|---|---|---|---|---|---|
| | 12 | : | 40 | 10 | :: | 11 | 2 | : | $x$ |
| | 20 | | 20 | | | 20 | | | |
| | $\overline{240}$ | | $\overline{810}$ | | | $\overline{222}$ | | | |

$$x = \frac{\overset{27}{\cancel{810}} \times \overset{111}{\cancel{222}}}{\underset{\underset{4}{8}}{\cancel{240}}} = \frac{2997}{4} \text{ dwts.} = 37 \text{ oz. 9 dwts. 6 grs.}$$

(5)...
$$1\tfrac{5}{17}+1\tfrac{6}{17}+1\tfrac{9}{17} = 2\tfrac{13}{17}$$

$$2\tfrac{13}{17} \ : \ 1\tfrac{5}{17} \ :: \ 1880 \ : \ x$$

$$x = \frac{17}{47} \times \frac{22}{17} \times \frac{\overset{40}{\cancel{1880}}}{1} = 880, \text{ number for D}$$

$$2\tfrac{13}{17} \ : \ 1\tfrac{6}{17} \ :: \ 1880 \ : \ 640, \text{ number for E}$$

$$2\tfrac{13}{17} \ : \ 1\tfrac{9}{17} \ :: \ 1880 \ : \ 360, \text{ number for F}$$

(6)...        $4\tfrac{1}{4}$ miles $= 7480$ yards

men da. hrs. men da. hrs.     yds. ft. in.    yds. ft. in.
$27 \times 31\tfrac{1}{4} \times 11 : 60 \times x \times 12 :: 660 \times 10 \times 22\tfrac{1}{2} : 7480 \times 12 \times 27$

$$x = \frac{27 \times 31\tfrac{1}{4} \times 11 \times 7480 \times 12 \times 27}{60 \times 12 \times 660 \times 10 \times 22\tfrac{1}{2}} = \frac{1683}{8} \text{ da.} = 210\tfrac{3}{8} \text{ days}$$

(7)...Annual rent of cottages $= 2s.\ 6d. \times 12 \times 52 = £78$

$$£ \qquad\qquad £$$
$$1000 \ : \ 78 \ :: \ 100 \ : \ 7\tfrac{4}{5} \text{ per cent.}$$

(8)...

|  |  | £ | s. | d. |  |
|---|---|---|---|---|---|
| 4 per cent. $= \tfrac{1}{25}$ | | 1050 | 12 | 6 | principal |
| $\tfrac{1}{2}$ „ „ $= \tfrac{1}{8}$ | | 42 | 0 | 6 | $\left.\begin{array}{c} \\ \end{array}\right\}$ interest for 1st year |
| | | 5 | 5 | $0\tfrac{3}{4}$ | |
| 4 per cent. $= \tfrac{1}{25}$ | | 1097 | 18 | $0\tfrac{3}{4}$ | amount at end of 1st year |
| $\tfrac{1}{2}$ „ „ $= \tfrac{1}{8}$ | | 43 | 18 | $3\tfrac{87}{100}$ | $\left.\begin{array}{c} \\ \end{array}\right\}$ interest for 2nd year |
| | | 5 | 9 | $9\tfrac{387}{800}$ | |
| 4 per cent. $= \tfrac{1}{25}$ | | 1147 | 6 | $2\tfrac{83}{800}$ | amount at end of 2nd year |
| $\tfrac{1}{2}$ „ „ $= \tfrac{1}{8}$ | | 45 | 17 | $10\tfrac{3283}{20000}$ | $\left.\begin{array}{c} \\ \end{array}\right\}$ interest for 3rd year |
| | | 5 | 14 | $8\tfrac{123283}{160000}$ | |
| | £ | 1198 | 18 | $9\tfrac{6147}{160000}$ | amount |

$(9)\ldots \dfrac{\sqrt{9}+\sqrt{5}}{\sqrt{9}-\sqrt{5}} \times \dfrac{\sqrt{9}+\sqrt{5}}{\sqrt{9}+\sqrt{5}} = \dfrac{14+6\sqrt{5}}{4} = 3\frac{1}{2}+\frac{3}{2}\sqrt{5}$

$$= 3\cdot5 + (\tfrac{3}{2} \text{ of } 2\cdot23607)$$
$$= 3\cdot5 + 3\cdot3541$$
$$= 6\cdot8541$$

$$19465109(269$$
$$8$$
$2^2 \times 300 = 1200 )\overline{11465}$
$$\overline{7200} = 1200 \times 6$$
$$2160 = 2 \times 30 \times 6^2$$
$$216 = 6^3$$
$$\overline{9576} \text{ subtrahend}$$
$26^2 \times 300 = 202800 )\overline{1889109}$
$$\overline{1825200} = 202800 \times 9$$
$$63180 = 26 \times 30 \times 9^2$$
$$729 = 9^3$$
$$\overline{1889109}$$

$\sqrt[3]{238\frac{41}{125}} = \sqrt[3]{\frac{29791}{125}} = \frac{31}{5} = 6\frac{1}{5}$

### EXERCISE CXXXII.

$(1)\ldots \qquad \dfrac{\cdot12}{\cdot0024 \times \cdot007}{\cdot00014} = \cdot12$
$$\cdot07$$

$(2)\ldots \quad 7\cdot6849542 \div 3520 = \cdot002183225625$
$$\sqrt{\cdot002183225625} = \cdot046725$$

$(3)\ldots \qquad\qquad\quad 973^2 = 946729$
Difference of squares $= 319465$
Square of less no. $= \overline{627264}(792$
$$49$$
$149 )\overline{1372}$
$$1341$$
$1582 )\quad \overline{3164}$
$$\underline{3164}$$

(4)...  $(5\frac{1}{2})^2$  :  $(7)^2$  ::  $105\frac{7}{8}$  :  No. of Eng. ac.

$$\frac{\cancel{4}}{\cancel{121}}\times\frac{49}{1}\times\frac{\overset{7}{\cancel{847}}}{\underset{2}{\cancel{8}}} = \frac{343}{2} = 171\frac{1}{2} \text{ Eng. acres}$$

(5)...                92 gallons = 46 dozen

£    *s.*
46 dozen at 47*s.* 6*d.* per dozen = 109   5
          cost =   85   0
        profit   £24   5*s.*

(6)...        £5762 10*s.* $\times\frac{3}{5}$ = £3457 10*s.*

£   *s.*      £       £   *s.*  *d.*
3457 10   :   1   ::   259   6   3   :   *x*
   2         2         20
6915        2      5186
                      12
                  62235

$$x = \frac{2\times\overset{9}{\cancel{62235}}}{\cancel{6915}} = 18d. = 1s.\ 6d. \text{ in the pound}$$

(7)...        £   *s.*  *d.*       £   *s.*  *d.*
        1   1   9 $\times 365$ = 396   18   9
     $\frac{2}{15}$ of 550 guineas =   77   0   0
                    £473   18   9

£   *s.*  *d.*
     550 guineas = 577   10   0
Annual expenditure = 473   18   9
  ,,     savings ...... £103   11   3

(8)...

$$60)\overline{57''}$$
$$60)\overline{37\cdot95'}$$
$$65°\ 37'\ 57'' = \overline{65\cdot6325°}$$

$$\cancel{360}°\ :\ 65\cdot6325°\ ::\ \cancel{400}^s$$
$$9 \qquad\qquad 10 \qquad 10$$
$$9)\overline{656\cdot3250}$$
$$\overline{72\cdot9250}^s = 72^s\ 92^`\ 50''$$

(9)...

$$\sqrt{88\tfrac{44}{49}} = \sqrt{\tfrac{4356}{49}} = \tfrac{66}{7} = 9\tfrac{3}{7}$$

$$\sqrt[3]{254\tfrac{1}{27}} = \sqrt[3]{\tfrac{6859}{27}} = \tfrac{19}{3} = 6\tfrac{1}{3}$$

(10)...   Common difference $= \dfrac{l-a}{m+1} = \dfrac{12\tfrac{1}{2}-3\tfrac{1}{2}}{5+1} = 1\tfrac{1}{2}$

the means are 5, $6\tfrac{1}{2}$, 8, $9\tfrac{1}{2}$, 11

17th term $= 7+(17-1)3 = 7+48 = 55$

## EXERCISE CXXXIII.

(1)...   1.   $(5\tfrac{3}{8}-2\tfrac{5}{12}) \times (7\tfrac{1}{5}-3\tfrac{3}{10}) \times (8\tfrac{5}{8}-4\tfrac{7}{9})$

$= (5\tfrac{9}{24}-2\tfrac{10}{24}) \times (7\tfrac{2}{10}-3\tfrac{3}{10}) \times (8\tfrac{45}{18}-4\tfrac{14}{18})$

$= 2\tfrac{23}{24} \times 3\tfrac{9}{10} \times 4\tfrac{1}{18}$

$$= \dfrac{71}{\cancel{24}_{8}} \times \dfrac{\overset{13}{\cancel{39}}}{10} \times \dfrac{73}{18} = \dfrac{67379}{1440} = 46\tfrac{1139}{1440}$$

2.   $\dfrac{\sqrt{24+\sqrt{289}+\sqrt[3]{512}}}{\sqrt{76+\sqrt{361}-\sqrt[3]{2744}}} = \dfrac{\sqrt{24+17+8}}{\sqrt{76+19-14}} = \dfrac{\sqrt{49}}{\sqrt{81}} = \dfrac{7}{9}$

3.   $\dfrac{1}{8\tfrac{5}{9}} = \dfrac{9}{77}$,   $\dfrac{1}{7\tfrac{9}{77}} = \dfrac{77}{548}$,   $\dfrac{8}{4\tfrac{77}{548}} = \dfrac{1644}{2269}$

(2)...
$$7 \cdot 8625 = 7\tfrac{69}{80}$$

$$13\tfrac{5}{16} + 7\tfrac{69}{80} + 5\tfrac{9}{20} = 25 + \tfrac{5}{16} + \tfrac{69}{80} + \tfrac{9}{20}$$

$$= 25 + \frac{25 + 69 + 36}{80}$$

$$= 25 + \tfrac{130}{80}$$

$$= 26\tfrac{5}{8} = 26 \cdot 625$$

$$\frac{7}{11} \text{ of } 89\tfrac{8}{25} = \frac{7}{11} \times \frac{\overset{203}{\cancel{2233}}}{25} = \frac{1421}{25} = 56\tfrac{21}{25}$$

$$56\tfrac{21}{25} - 26\tfrac{5}{8} = 30\tfrac{43}{200} = 30 \cdot 215$$

(3)...
$$19 \cdot 9875 = 19\tfrac{79}{80}$$

$$7\tfrac{5}{8} \times \left(\tfrac{23}{40} \text{ of } 19\tfrac{79}{80}\right) = \tfrac{61}{8} \times \tfrac{23}{40} \times \tfrac{1599}{80}$$

$$= \tfrac{2243397}{25600} = 87\tfrac{16197}{25600} = 87 \cdot 6326953125$$

$$35 \cdot 525 = 35\tfrac{21}{40}$$

$$35\tfrac{21}{40} \div \left(\tfrac{5}{9} \text{ of } 7\tfrac{1}{7}\right) = \tfrac{1421}{40} \times \tfrac{9}{5} \times \tfrac{7}{50}$$

$$= \tfrac{89523}{10000} = 8\tfrac{9523}{10000} = 8 \cdot 9523$$

(4)...
$$\tfrac{7}{24} \text{ crown} = \tfrac{7}{96} \text{ sov.} \qquad \tfrac{1}{16} \text{ gui.} = \tfrac{21}{320} \text{ sov.}$$

$$\tfrac{7}{96}, \ \tfrac{1}{16}, \ \tfrac{21}{320} = \tfrac{70}{960}, \ \tfrac{64}{960}, \ \tfrac{63}{960}$$

(5)...
$$(\cdot\dot{8}\dot{3})^2 \times \cdot 85714\dot{2} = \left(\frac{5}{6}\right)^2 \times \frac{6}{7} = \frac{25}{\underset{6}{\cancel{36}}} \times \frac{\cancel{6}}{7} = \frac{25}{42}$$

$$= \cdot 59\dot{5}23809$$

Y

(6)...
$$\cdot 633 \text{ \&c. } = \frac{63-6}{90} = \frac{57}{90} = \frac{19}{30}$$

$$\cdot 63 = \tfrac{6\,3}{1\,0\,0}$$

$$\frac{19}{\overset{}{\underset{6}{\cancel{30}}}} \times \frac{\overset{5}{\cancel{25}}}{1} = \frac{95}{6}s. = 15s.\ 10d.$$

$$\frac{63}{\overset{}{\underset{4}{\cancel{100}}}} \times \frac{\cancel{25}}{1} = \frac{63}{4}s. = 15s.\ \ 9d.$$

$$\text{difference} = \overline{\qquad 1d.}$$

<br>

(7)...
| yds. | in. | | yds. | in. | | £ | s. | d. | | |
|---|---|---|---|---|---|---|---|---|---|---|
| $37\frac{1}{2}$ | $\times 22$ | : | $53\frac{1}{2}$ | $\times 25$ | :: | 8 | 11 | $10\frac{1}{2}$ | : | $x$ |
| 2 | | | 2 | | | | 20 | | | |
| $\overline{75}$ | | | $\overline{107}$ | | | | $\overline{171}$ | | | |
| | | | | | | | 12 | | | |
| | | | | | | | $\overline{2062}$ | | | |
| | | | | | | | 4 | | | |
| | | | | | | | $\overline{8250}$ | | | |

$$x = \frac{107 \times 25 \times \overset{\overset{5}{\cancel{110}}}{\cancel{8250}}}{\underset{\cancel{3}}{\cancel{75}} \times \cancel{22}} = 13375 \text{ far. } = \pounds 13\ 18s.\ 7\tfrac{3}{4}d.$$

<br>

(8)...While the hour hand goes once round, the minute hand goes round 12 times : hence the minute hand gains 11 rounds in 12 hours.

In the question, the minute hand has to gain 8 rounds.

| ro. | | ro. | | hrs. | | hrs. | min. |
|---|---|---|---|---|---|---|---|
| 11 | : | 8 | :: | 12 | : | 8 | $43\frac{7}{11}$ |

∴ the hands will be together at $43\frac{7}{11}$ min past 8.

☞ $43\frac{7}{11}$ minutes is the same fraction of 1 hour that 8 hours $43\frac{7}{11}$ minutes is of 12 hours, viz. $\frac{8}{11}$.

(9)...

$$116323287844(341062$$
$$9$$
$$64)\ \overline{263}$$
$$256$$
$$681)\ \overline{723}$$
$$681$$
$$68206)\ \overline{422878}$$
$$409236$$
$$682122)\ \overline{1364244}$$
$$1364244$$

$$\sqrt{837201991720249} = 28934443$$

$$28934443(307$$
$$27$$
$$30^2 \times 300 = 270000)\ \overline{1934443}$$
$$1890000 = 270000 \times 7$$
$$44100 = 30 \times 30 \times 7^2$$
$$343 = 7^3$$
$$\overline{1934443}$$

(10)...  $3\sqrt[3]{448} + 2\sqrt[3]{875} - 4\sqrt[3]{56} + 2\sqrt[3]{1512}$

$= 3\sqrt[3]{64 \times 7} + 2\sqrt[3]{125 \times 7} - 4\sqrt[3]{8 \times 7} + 2\sqrt[3]{216 \times 7}$

$= 12\sqrt[3]{7} + 10\sqrt[3]{7} - 8\sqrt[3]{7} + 12\sqrt[3]{7}$

$= 26\sqrt[3]{7}$

### EXERCISE CXXXIV.

(1)...The train from London has travelled 48 miles when the train starts from Chester.

$$178 \text{ miles} - 48 \text{ miles} = 130 \text{ miles}$$

The trains will meet in $\{130 \div (24 + 21)\}$ $2\frac{8}{9}$ hours, or 2 hours $53\frac{1}{3}$ minutes after the train leaves Chester.

$$\begin{array}{ll} \text{hrs.} & \text{min.} \\ 8 & 30 \text{ A.M.} \\ 2 & 53\frac{1}{3} \\ \hline 11 & 23\frac{1}{3} \text{ A.M.} \end{array}$$

time of meeting

distance from Chester $= 21 \times 2\frac{8}{9} = 60\frac{2}{3}$ miles

(2)...     $60 \times 24 \times 2 = 2880$, No. of leaves

$$2880 \begin{cases} \overset{\text{in.}}{12)\overline{13 \cdot 5}} = 13\tfrac{1}{2} \text{ inches} \\ 12)\ \overline{1 \cdot 125} \\ 20)\ \overline{\ \cdot 09375} \\ \hline \qquad \cdot 0046875 \text{ of an inch} \end{cases}$$

(3)... 
$$\begin{array}{ccccccc} \text{yds.} & \text{yds.} & & & \pounds \ s. & & \pounds \ s. \\ 250 \times 242 & : & x & :: & 7 \ 10 & : & 5 \ 5 \\ & & & & 20 & & 20 \\ & & & & \overline{150} & & \overline{105} \end{array}$$

$$x = \frac{\overset{5}{\cancel{250}} \times 242 \times \overset{35}{\cancel{105}}}{\underset{3}{\cancel{150}}} = 42350 \text{ sq. yds.} = 8\tfrac{3}{4} \text{ acres}$$

(4)... 
$$\begin{array}{ccccccc} & & & & \text{oz. dwt.} & & \\ 10 \cdot 47 & : & 19 \cdot 35 & :: & 17 \ 15 & : & x \\ & & & & 20 & & \\ & & & & \overline{355} & & \end{array}$$

$$x = \frac{19 \cdot 35 \times 355}{10 \cdot 47} = 656\tfrac{31}{349} \text{ dwt.} = 32 \text{ oz. } 16\tfrac{31}{349} \text{ dwt.}$$

(5)... $100°$ of Centigrade $= 212° - 32° = 180°$ of Fahrenheit

$\therefore 1°$ of Centigrade $= \tfrac{9}{5}$ of a degree of Fahrenheit
and $1°$ of Fahrenheit $= \tfrac{5}{9}$ of a degree of Centigrade

Hence, the degree on the Centigrade corresponding to $86°$ of Fahrenheit $= \tfrac{5}{9}(86 - 32) = \tfrac{5}{9} \cdot 54° = 30°$.

(6)...The degree on Fahrenheit corresponding to $25°$ on the Centigrade $= \tfrac{9}{5} \cdot 25° + 32° = 45° + 32° = 77°$.

(7)... The watch marks 32 hours 5 minutes in 32 hours

From noon on Thursday to 6.30 P.M. on the following Tuesday = $126\frac{1}{2}$ hours

$$
\begin{array}{ccccccc}
\text{hrs.} & \text{min.} & & \text{hrs.} & \text{min.} & & \text{hrs.} \\
32 & 5 & : & 126 & 30 & :: & 32 & : & x \\
& 60 & & & 60 & \\
\hline
& 1925 & & & 7590 &
\end{array}
$$

$$x = \dfrac{\overset{138}{\cancel{7590}} \times 32}{\underset{35}{\cancel{1925}}} = \frac{4416}{35} \text{ hrs.} = 126 \text{ hrs. } 10\frac{2}{7} \text{ min.}$$

∴ when the hands point to 6.30 on Tuesday evening the correct time is 6 hrs. $10\frac{2}{7}$ min.

(8)... 27th term $= 5 + (27-1)2\frac{1}{2} = 5 + 65 = 70$

(9)... Sum of series $= \{2a + (n-1)d\}\dfrac{n}{2}$

$$= \{14\tfrac{1}{2} + (15 \times 1\tfrac{3}{8})\}8$$
$$= (14\tfrac{1}{2} + 20\tfrac{5}{8})8$$
$$= 35\tfrac{1}{8} \times 8 = 281$$

(10)... $(1\frac{4}{5})^5 \times (2\frac{7}{9})^3 = \dfrac{9}{5} \times \dfrac{9}{5} \times \dfrac{9}{5} \times \dfrac{9}{5} \times \dfrac{9}{5} \times \dfrac{25}{9} \times \dfrac{25}{9} \times \dfrac{25}{9}$

$$= 405$$

$(2\frac{2}{3})^6 \div (3\frac{5}{9})^3 = \dfrac{8}{3} \times \dfrac{8}{3} \times \dfrac{8}{3} \times \dfrac{8}{3} \times \dfrac{8}{3} \times \dfrac{8}{3} \times \dfrac{9}{32} \times \dfrac{9}{32} \times \dfrac{9}{32}$

$$= 8$$

## EXERCISE CXXXV.

(1)...

$$\begin{array}{r}\text{ton}\\ \cdot 00029296875 = 10\tfrac{1}{2}\text{ ounces}\\ 20\\ \hline \cdot 00585937500\\ 4\\ \hline \cdot 02343750000\\ 28\\ \hline \cdot 65625000000\\ 16\\ \hline 10\cdot 50000000000\text{ oz.}\end{array}$$

(2)...

$$£7\ 14s. \div 23\tfrac{7}{15} = \frac{\cancel{154}^{\ 7}}{1} \times \frac{15}{\cancel{352}_{\ 16}} = \frac{105}{16}s. = 6s.\ 6\tfrac{3}{4}d.$$

$$\begin{array}{r}\text{far.}\\ 4)3\\ 12)\overline{6\cdot 75}\\ 21)\overline{6\cdot 5625}\\ 6s.\ 6\tfrac{3}{4}d. = \qquad \overline{\cdot 3125}\text{ of a guinea}\end{array}$$

(3)...

$$\cdot 0025 = \tfrac{25}{10000} = \tfrac{1}{400}$$

$$\cdot 0025\text{ of a week} = \frac{1}{\cancel{400}_{\ 50}} \times \frac{7}{1} \times \frac{\cancel{24}^{\ 3}}{1} = \frac{21}{50}\text{ of an hour}$$

(4)...

$$\begin{array}{r}7\cdot 46875\text{ gui.} = £7\ 16s.\ 10\tfrac{1}{8}d.\\ 21\\ \hline 9\cdot 84375s.\\ 12\\ \hline 10\cdot 12500d.\end{array}$$

$$£5 \cdot 2609375 \ = \ £5 \quad 5s. \quad 2\tfrac{5}{8}d.$$
$$\underline{20}$$
$$\overline{5 \cdot 2187500s.}$$
$$\underline{12}$$
$$\overline{2 \cdot 6250000d.}$$

$$17 \cdot 175 \text{ hf. cr.} \ = £2 \quad 2s. \quad 11\tfrac{1}{4}d.$$
$$\underline{30}$$
$$\overline{5 \cdot 250d.}$$
$$\underline{4}$$
$$\overline{1 \cdot 000} \text{ far.}$$

$$\overline{£15 \quad 5s. \quad 0d.}$$

$$\frac{11}{14} \text{ of } £22\ 15s. = \frac{11}{\cancel{14}_{2}} \times \frac{\cancel{91}^{13}}{4} = £\frac{143}{8} = £17\ 17s.\ 6d.$$

$$£17\ 17s.\ 6d. - £15\ 5s. = £2\ 12s.\ 6d.$$

(5)...
$$\cdot 017 \ : \ x \ :: \ x \ : \ \cdot 153$$
$$x^2 = \cdot 017 \times \cdot 153$$
$$= \cdot 002601$$
$$\therefore x = \cdot 051$$

(6)...
$$\overset{\text{ft.}}{4\tfrac{1}{4}} \times \overset{\text{ft.}}{1\tfrac{3}{4}} \times \overset{\text{ft.}}{1\tfrac{1}{4}} \ : \ \overset{\text{ft.}}{5\tfrac{1}{2}} \times \overset{\text{ft.}}{2\tfrac{1}{4}} \times \overset{\text{ft.}}{1\tfrac{3}{4}} \ :: \ \overset{\text{lb.}}{1338\tfrac{3}{4}} \ : \ x$$

$$x = (5\tfrac{1}{2} \times 2\tfrac{1}{4} \times 1\tfrac{3}{4} \times 1338\tfrac{3}{4}) \div (4\tfrac{1}{4} \times 1\tfrac{3}{4} \times 1\tfrac{1}{4})$$

$$= \frac{11}{2} \times \frac{9}{4} \times \frac{7}{4} \times \frac{\cancel{5355}}{4} \times \frac{\cancel{4}}{\cancel{17}} \times \frac{\cancel{4}}{7} \times \frac{\cancel{4}}{\cancel{5}}$$

$$= \tfrac{6237}{2} \text{ lb.} = 3118\tfrac{1}{2} \text{ lb.}$$

$$(7)\ldots\quad \overset{\text{ac. yr.}}{17\tfrac{1}{2}\times\tfrac{3}{4}}\ :\ \overset{\text{ac: yr.}}{262\tfrac{1}{2}\times\tfrac{1}{2}}\ ::\ \overset{£\ s.\ d.}{82\ 16\ 3}=\overset{£}{32\tfrac{13}{16}}\ :\ x$$

$$x=\frac{\cancel{2}}{\cancel{35}}\times\frac{\cancel{4}}{\cancel{3}}\times\frac{\overset{15}{\cancel{525}}}{\cancel{2}}\times\frac{1}{2}\times\frac{\overset{175}{\cancel{525}}}{\underset{4}{\cancel{16}}}=£\frac{2625}{8}=£328\ 2s.\ 6d.$$

$$(8)\ldots\qquad \overset{£}{67\tfrac{1}{2}}\ :\ \overset{£}{100}\ ::\ \overset{£}{3}\ :\ x$$
$$\qquad\qquad \frac{2}{135}\qquad \frac{2}{200}$$

$$x=\frac{\overset{40}{\cancel{200}}\times3}{\underset{27}{\cancel{135}}}=£\frac{120}{27}=£4\ 8s.\ 10\tfrac{2}{3}d.\ \text{int. in 3 per cents,}$$

$$\overset{£}{77\tfrac{1}{2}}\ :\ \overset{£}{100}\ ::\ \overset{£}{3\tfrac{1}{2}}\ :\ x$$
$$\frac{2}{155}\qquad\qquad \frac{2}{7}$$

$$x=\frac{\overset{20}{\cancel{100}}\times7}{\underset{31}{\cancel{155}}}=£\frac{140}{31}=£4\ 10s.\ 3\tfrac{27}{31}d.\ \text{int. in }3\tfrac{1}{2}\text{ per cents.}$$

An investment in the $3\tfrac{1}{2}$ per cents. will yield the better interest.

(9)...

$$30099783950929(5486327$$
$$25$$
$$104)\ \overline{509}$$
$$416$$
$$1088)\ \overline{9397}$$
$$8704$$
$$10966)\ \overline{69383}$$
$$65796$$
$$109723)\ \overline{358795}$$
$$329169$$
$$1097262)\ \overline{2962609}$$
$$2194524$$
$$10972647)\ \overline{76808529}$$
$$76808529$$

$$586376253(837$$
$$512$$
$$8^2 \times 300 = 19200)\overline{74376}$$
$$\overline{57600} = 19200 \times 3$$
$$2160 = 8 \times 30 \times 3^2$$
$$27 = 3^3$$
$$\overline{59787} \text{ subtrahend}$$
$$83^2 \times 300 = 2066700)\overline{14589253}$$
$$\overline{14466900} = 2066700 \times 7$$
$$122010 = 83 \times 30 \times 7^2$$
$$343 = 7^3$$
$$\overline{14589253}$$

(10)...

1.   $\text{Sum} = \{2a+(n-1)d\}\dfrac{n}{2}$

$= \{6\tfrac{1}{3}+(18\times\tfrac{5}{9})\}\tfrac{19}{2}$

$= (6\tfrac{4}{9}+10)\tfrac{19}{2}$

$= 16\tfrac{4}{9}\times\tfrac{19}{2} = 156\tfrac{2}{9}$

2.   $\text{Sum} = \{2a+(n-1)d\}\dfrac{n}{2}$

$= \{10\tfrac{1}{3}+(31\times\tfrac{1}{2})\}16$

$= (10\tfrac{1}{3}+15\tfrac{1}{2})16$

$= 25\tfrac{5}{6}\times16 = 413\tfrac{1}{3}$

3.      $\text{Sum} = \{2a+(n-1)d\}\frac{n}{2}$

$= \{\frac{7}{6}+(23\times\frac{5}{13})\}\,12$

$= (\frac{7}{6}+9\frac{7}{13})12$

$= 10\frac{3}{4}\times12 = 129$

## EXERCISE CXXXVI.

(1)... $\overset{s.}{66}$ : $\overset{s.\ d.}{2\ 6}$ :: $\overset{oz.}{12}$ : $\overset{oz.}{\frac{5}{11}}$, weight of half-crown

$\frac{37}{\cancel{40}\ 8}$ of $\frac{5}{11}$ oz. $= \frac{37}{88}$ oz. $= 8$ dwt. $9\frac{9}{11}$ grs. of silver

$\frac{3}{\cancel{40}\ 8}$ of $\frac{5}{11}$ oz. $= \frac{3}{88}$ oz. $= 16\frac{4}{11}$ grs. of copper

(2)...          1 ton = 15680000 grains

$\overset{grs.}{\cancel{200}}$ : $\overset{grs.}{\cancel{15680000}}$ :: $\overset{grs.}{\cdot137}$
                        78400
                         ·137
                  $24\overline{)10740\cdot8}$ grains
                  $20)\ \ 447\ \ \ 12\frac{4}{5}$
                  _____
                  . 22 oz. 7 dwts. $12\frac{4}{5}$ grs.

(3)...                              5′ W.
                          151° 14′ E.
     Difference of longitude = $\overline{151°\ \ 19′}$

                        min.
     1° : 151° 19′ :: 4 : 10 hrs. 5 min. 16 sec.

     i.e. the time at Sydney is 10 hrs. 5 min. 16 sec. P.M.

(4)...     Longitude of Liverpool    2° 59′ W.
     „ of Calcutta    88° 25′ E.
   Difference of longitude    91° 24′

<center>min.</center>

1° : 91° 24′ :: 4 : 6 hrs. 5 min. 36 sec.

  Time at Calcutta 12 hrs. 0 min. 0 sec.
  Difference of time 6 hrs. 5 min. 36 sec.
  Time at Liverpool = 5 hrs. 54 min. 24 sec.

(5)...    £21000 × $\frac{5}{6}$ = £17500

<center>

£    £   £ s.   £ s.
100 : 17500 :: 3 10 : 612 10

</center>

          £ s.
     Cost of ship 21000 0
    Paid for insurance  612 10
          21612 10
Received from insurance company 17500 0
      Total loss = £4112 10s

          Ch. ac.
(6)...  $(5\frac{1}{2})^2$ : $(8)^2$ :: 140 : x

          ac. po. yds.
$x = \frac{4}{121} \times \frac{64}{1} \times \frac{140}{1} = \frac{35840}{121}$ stat. ac. = 296 31 22$\frac{1}{4}$

           £
(7)...   Gross value of legacy 4500
    Deduct duty, $\frac{1}{10}$th 450
    Net value of legacy 4050

<center>2 + 3 + 4 = 9</center>

<center>

       £   £
9 : 2 :: 4050 : 900
9 : 3 :: 4050 : 1350
9 : 4 :: 4050 : 1800

</center>

(8)...½ year's int.=$\frac{1}{50}$

| | | £ | s. | d. | |
|---|---|---|---|---|---|
| | | 550 | 0 | 0 | principal |
| | | 11 | 0 | 0 | int. for 1st half-year |
| ,, | ,, | 561 | 0 | 0 | amt. at end of 1st hf.-yr. |
| | | 11 | 4 | 4½ | int. for 2nd half-year |
| ,, | ,, | 572 | 4 | 4½ | amt. at end of 2nd hf.-yr. |
| | | 11 | 8 | 10$\frac{8.2}{125}$ | int. for 3rd half-year |
| ,, | ,, | 583 | 13 | 3$\frac{5.7}{125}$ | amt. at end of 3rd hf.-yr. |
| | | 11 | 13 | 5$\frac{181}{3125}$ | int. for 4th half-year |
| ,, | ,, | 595 | 6 | 9$\frac{141}{3125}$ | amt. at end of 4th hf.-yr. |
| | | 11 | 18 | 1$\frac{8508}{78125}$ | int. for 5th half-year |
| | | £607 | 4 | 10$\frac{42033}{78125}$ | amount in 3½ years |

(9)...

$$a+(n-1)d = l$$

From this, $n = \dfrac{l-a+d}{d}$

No. of terms $= \dfrac{26\frac{3}{4}-5\frac{1}{2}+1\frac{1}{4}}{1\frac{1}{4}}$

$$= \dfrac{22\frac{1}{2}}{1\frac{1}{4}} = 18$$

Sum of series $= (a+l)\dfrac{n}{2}$

$$= (5\tfrac{1}{2}+26\tfrac{3}{4})9$$
$$= 32\tfrac{1}{4}\times 9$$
$$= 290\tfrac{1}{4}$$

(10)...

$$\frac{\sqrt{5+\frac{1}{3}} \div \sqrt{4-\frac{4}{5}}}{\sqrt{5+\frac{1}{3}} \times \sqrt{4-\frac{4}{5}}} = \frac{\frac{4}{\sqrt{3}} \div \frac{4}{\sqrt{5}}}{\frac{4}{\sqrt{3}} \times \frac{4}{\sqrt{5}}} = \frac{\frac{\sqrt{5}}{\sqrt{3}}}{\frac{16}{\sqrt{3}.\sqrt{5}}}$$

$$= \frac{\sqrt{5} \times \sqrt{3} \times \sqrt{5}}{16 \times \sqrt{3}} = \frac{5}{16}$$

## EXERCISE CXXXVII.

(1)...
$$\underset{\text{in.}}{29\tfrac{1}{2}} \times \underset{\text{in.}}{22\tfrac{3}{4}} \times 24 \times 20 = 322140 \text{ square inches}$$
$$= 248 \text{ sq. yds. } 5 \text{ sq. ft. } 12 \text{ sq. in.}$$

(2)...
$$10 \text{ cu. ft. } 1188 \text{ cu. in.} = 18468 \text{ cu. inches}$$
$$1 \text{ cu. yard} = 46656 \text{ „ „}$$
$$\tfrac{18468}{46656} \div \tfrac{972}{972} = \tfrac{19}{48} \text{ of a cubic yard}$$

(3)...
$$\left(\frac{5-3\frac{2}{3}}{2\frac{2}{3}+2\frac{5}{9}}\right)^{\frac{1}{2}}+\left(\frac{4\frac{1}{12}+2\frac{2}{3}}{13\frac{5}{12}-3\frac{1}{3}}\right)^{\frac{1}{2}} = \sqrt{\frac{16}{49}}+\sqrt{\frac{81}{121}}$$
$$= \frac{4}{7}+\frac{9}{11} = \frac{44+63}{77} = \frac{107}{77} = 1\frac{30}{77}$$

(4)...
$$\underset{\text{£ s. d.}}{3\ 17\ 10\tfrac{1}{2}} = 3738 \ : \ \underset{\text{far.}}{960} \ :: \ \underset{\text{far.}}{20} \ : \ \underset{\text{dwt.}}{x}$$

$$x = \frac{\overset{160}{\cancel{960}} \times 20}{\underset{623}{\cancel{3738}}} = \frac{3200}{623} \text{ dwt.} = 5 \text{ dwt. } 3\tfrac{171}{623} \text{ grs.}$$

(5)...Reduction on refined sugar 5s. 6d. per cwt.; on brown sugar 3s. 4d. per cwt.

¾ lb. × 365 = 273¾ lb. refined; 1¾ lb. × 365 = 638¾ lb. brown

$$\underset{\text{lb.}}{112} \ : \ \underset{\text{lb.}}{273\tfrac{3}{4}} \ :: \ \underset{\text{s. d.}}{5\ \ 6} \ : \ 13s.\ 5\tfrac{71}{224}d.$$

$$\underset{\text{lb.}}{112} \ : \ \underset{\text{lb.}}{638\tfrac{3}{4}} \ :: \ \underset{\text{s. d.}}{3\ \ 4} \ : \ 19s.\ 0\tfrac{1}{8}d.$$

$$13s.\ 5\tfrac{71}{224}d. + 19s.\ 0\tfrac{1}{8}d. = £1\ 12s.\ 5\tfrac{99}{224}d.$$

(6)...     36 dozen at 16 for a shilling $=$ $\overset{s.}{27}$

$\qquad\qquad\qquad\qquad$ cost $=$ $\underline{21}$

$\qquad\qquad\qquad\qquad$ profit $=$ $\overline{6s.}$

$\overset{s.}{21}$ : $\overset{s.}{6}$ :: 100 : $28\frac{4}{7}$ per cent.

(7)...  12875
$\qquad$ 5375
$\qquad$ $\underline{16750}$

$\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ £   s.   d.

$\overline{35000}$ cu. ft. at 4s. 6d. per thousand $=$  7  17  6

$\qquad\qquad$ $2\frac{1}{2}$ per cent. discount $= \frac{1}{40} =$ $\qquad$ 3  11$\frac{1}{4}$

$\qquad\qquad\qquad$ cost of gas for the year $= £7$ $\overline{13}$ $\overline{6\frac{3}{4}}$

$\qquad$ £7 13s. 6$\frac{3}{4}$d.$+365 = 5\frac{71}{1460}$d. per night.

(8)...     Less number $= \sqrt{281961} = 531$

$\qquad\qquad$ sum of cubes $=$ 604477900
$\qquad\qquad\qquad\qquad$ $531^3 =$ 149721291

cube of greater number $= \overline{454756609}(769$

$\qquad\qquad\qquad\qquad\qquad\qquad$ 343

$\qquad$ $7^2 \times 300 = 14700)\overline{111756}$

$\qquad\qquad\qquad\qquad\qquad$ $\overline{88200} = 14700 \times 6$
$\qquad\qquad\qquad\qquad\qquad$ $7560 = 7 \times 30 \times 6^2$
$\qquad\qquad\qquad\qquad\qquad$ $\underline{216} = 6^3$
$\qquad\qquad\qquad\qquad\qquad$ $\overline{95976}$ subtrahend

$76^2 \times 300 = 1732800)\overline{15780609}$

$\qquad\qquad\qquad\qquad\qquad$ $\overline{15595200} = 1732800 \times 9$
$\qquad\qquad\qquad\qquad\qquad$ $184680 = 76 \times 30 \times 9^2$
$\qquad\qquad\qquad\qquad\qquad$ $\underline{729} = 9^3$
$\qquad\qquad\qquad\qquad\qquad$ $\overline{15780609}$

(9)...   $\sqrt{1838\frac{17}{64}} = \sqrt{\frac{117649}{64}} = \frac{343}{8}$

$\qquad\qquad$ $\sqrt[3]{\frac{343}{8}} = \frac{7}{2} = 3\frac{1}{2}$

(10)...   F. $= \frac{9}{5} . 82\cdot5° + 32° = 148\cdot5° + 32° = 180\cdot5°$

## *EXERCISE CXXXVIII.*

(1)...

$$\left(\frac{6\frac{2}{3}}{8\frac{2}{5}}\times\frac{7\frac{5}{7}}{9\frac{9}{10\frac{1}{1}}}\times\frac{11\frac{4}{7}}{13\frac{1}{14}}\right)\div\frac{4\frac{4}{5}}{7\frac{2}{7}}$$

$$=\frac{\overset{5}{2\cancel{0}}}{2\cancel{7}}\times\frac{\cancel{11}}{\cancel{14}}\times\frac{\overset{\overset{3}{\cancel{6}}}{1\cancel{62}}}{\underset{7}{1\cancel{87}}}\times\frac{\overset{5}{8\cancel{5}}}{5\cancel{6}}=\frac{75}{98}$$

(2)...   $7\cdot9090\ \&c.=7\frac{10}{11};\qquad 9\cdot533\ \&c.=9\frac{8}{15}$

$$7\frac{10}{11}\times9\frac{8}{15}=\frac{\overset{29}{8\cancel{7}}}{\cancel{11}}\times\frac{\overset{13}{1\cancel{43}}}{\underset{5}{1\cancel{5}}}=\frac{377}{5}=75\frac{2}{5}=75\cdot4$$

$$13\cdot7=13\frac{7}{9};\qquad 4\cdot428571=4\frac{3}{7}$$

$$13\frac{7}{9}\div4\frac{3}{7}=\frac{\overset{4}{1\cancel{24}}}{9}\times\frac{7}{\cancel{31}}=\frac{28}{9}=3\frac{1}{9}=3\cdot1$$

(3)...   $\dfrac{1}{7}+\dfrac{2}{5}=\dfrac{5+14}{35}=\dfrac{19}{35};\qquad 1-\dfrac{19}{35}=\dfrac{16}{35}$

$$\frac{16}{35}\ :\ 1\ ::\ \overset{\text{ac.}}{3}\ :\ \text{area of field}$$

Area of field $=\frac{35}{16}\times\frac{3}{1}=\frac{105}{16}$ ac. $=$ 6 ac. 2 ro. 10 po.
Area of potatoes $=\frac{1}{7}$ of 6 ac. 2 ro. 10 po. $=$   3 ro. 30 po.
Area of tares $=\frac{2}{5}$ of 6 ac. 2 ro. 10 po. $=$ 2 ac. 2 ro. 20 po.

(4)...       1 cwt. 2 qrs. 12 lb. $=$ 180 lb.

100 : 18·34 :: 180 lb. : 33·012 lb. sulphate of potash
100 : 36·20 :: 180 lb. : 65·16 lb. sulphate of alumina
100 : 45·46 :: 180 lb. : 81·828 lb. water

(5)...        1 cu. foot of marble weighs 2700 ounces

$$\begin{array}{ccccccc} \text{oz.} & & \text{lb.} & & \text{cu. in.} & & \\ 2700 & : & 475 & :: & 1728 & : & x \\ & & 16 & & & & \\ \hline & & 7600 & & & & \end{array}$$

$$x = \frac{\overset{76}{\cancel{7600}} \times \overset{64}{\cancel{1728}}}{\underset{27}{\cancel{2700}}} = 4864 \text{ cu. in.} = 2 \text{ cu. ft. } 1408 \text{ cu. in.}$$

(6)...
$$\begin{array}{ccccccccc} \pounds & \text{yrs.} & \text{per cent.} & & \pounds & s. & \text{yrs.} & \text{per cent.} \\ x & \times 4\frac{1}{2} & \times 4 & = & 2563 & 16 & \times 5\frac{1}{2} & \times 4\frac{1}{2} \end{array}$$

$$x = (2563\tfrac{4}{5} \times 5\tfrac{1}{2} \times 4\tfrac{1}{2}) \div (4\tfrac{1}{2} \times 4)$$

$$= \frac{12819}{5} \times \frac{11}{2} \times \frac{9}{2} \times \frac{2}{9} \times \frac{1}{4}$$

$$= \pounds\frac{141009}{40} = \pounds3525 \ 4s. \ 6d.$$

(7)...
$$\begin{array}{ccccccccc} \pounds & s. & \text{yrs.} & \text{per cent.} & & \pounds & s. & \text{yrs.} & \text{per cent.} \\ 955 & 16 & \times x & \times 4\frac{1}{2} & = & 796 & 10 & \times 6 & \times 3\frac{3}{4} \end{array}$$

$$x = (796\tfrac{1}{2} \times 6 \times 3\tfrac{3}{4}) \div (955\tfrac{4}{5} \times 4\tfrac{1}{2})$$

$$= \frac{\cancel{1593}}{\cancel{2}} \times \frac{\cancel{6}}{1} \times \frac{\cancel{15}}{\cancel{2}} \times \frac{5}{\cancel{4779}} \times \frac{2}{\cancel{9}}$$

$$= \tfrac{25}{6} = 4\tfrac{1}{6} \text{ years}$$

(8)...
$$\begin{array}{ccccccccc} \pounds & s. & \text{yrs.} & \text{per cent.} & & \pounds & s. & \text{yrs.} & \text{per cent.} \\ 607 & 10 & \times 5 & \times x & = & 787 & 10 & \times 4\frac{1}{2} & \times 4\frac{1}{2} \end{array}$$

$$x = (787\tfrac{1}{2} \times 4\tfrac{1}{2} \times 4\tfrac{1}{2}) \div (607\tfrac{1}{2} \times 5)$$

$$= \frac{\cancel{1575}}{2} \times \frac{9}{2} \times \frac{9}{2} \times \frac{2}{\cancel{1215}} \times \frac{1}{5}$$

$$= \tfrac{21}{4} = 5\tfrac{1}{4} \text{ per cent.}$$

|  |  | £ | s. | d. |
|---|---|---|---|---|
| (9)... The first payment bears int. for 5 yrs. = | | 73 | 2 | 6 |
| The second „ „ „ 4 yrs. = | | 58 | 10 | 0 |
| The third „ „ „ 3 yrs. = | | 43 | 17 | 6 |
| The fourth „ „ „ 2 yrs. = | | 29 | 5 | 0 |
| The fifth „ „ „ 1 yr. = | | 14 | 12 | 6 |
| Interest = | | 219 | 7 | 6 |
| £325 × 5 = | | 1625 | 0 | 0 |
| Amount due £1844 | | 7 | 6 | |

(10)...

$$282429536481(531441$$
$$25$$
$$103)\ \overline{324}$$
$$309$$
$$1061)\ \overline{1529}$$
$$1061$$
$$10624)\ \overline{46853}$$
$$42496$$
$$106284)\ \overline{435764}$$
$$425136$$
$$1062881)\ \overline{1062881}$$
$$1062881$$

$$48228544(364$$
$$27$$
$$3^2 × 300 = 2700)\overline{21228}$$
$$\overline{16200} = 2700 × 6$$
$$3240 = 3 × 30 × 6^2$$
$$216 = 6^3$$
$$\overline{19656}\ \text{subtrahend}$$
$$36^2 × 300 = 388800)\ \overline{1572544}$$
$$\overline{1555200} = 388800 × 4$$
$$17280 = 36 × 30 × 4^2$$
$$64 = 4^3$$
$$\overline{1572544}$$

z

## *EXERCISE CXXXIX.*

|  | | £ | s. | |
|---|---|---|---|---|
| (1)... | Wages of captain............... | 25 | 0 | per month |
| | „    first mate............ | 7 | 10 | „    „ |
| | „    second mate ...... | 5 | 10 | „    „ |
| | „    steward ............ | 5 | 0 | „    „ |
| | „    cook.................. | 3 | 10 | „    „ |
| | „    18 seamen ......... | 45 | 0 | „    „ |
| | „    6 boys ............... | 4 | 10 | „    „ |
| | Total amount of wages = | 96 | 0 | „    „ |
| | Maintenance, £2 5s. × 29 = | 65 | 5 | „    „ |
| | Wages and keep = | 161 | 5 | „    „ |
| | | | 9 | |
| | | £1451 | 5 | |

$$\begin{array}{ccccccc} \text{ft. in.} & \text{ft. in.} & \text{ft. in.} & \text{ft. in.} & \pounds \; s. \; d. & \text{far.} \\ (2)...31 \; 6 \times 15 \; 2 & : & 28 \; 6 \times 17 \; 4 & :: & 17 \; 9 \; 1\tfrac{1}{2} = 16758 & : & x \end{array}$$

$$\begin{array}{cc} \underline{12} & \underline{12} \\ 378 & 182 \end{array} \qquad \begin{array}{cc} \underline{12} & \underline{12} \\ 342 & 208 \end{array}$$

$$x = \frac{\cancel{342} \times \cancel{208} \times \cancel{16758}}{\cancel{378} \times \cancel{182}} = 17328 \text{ far.} = \pounds18 \; 1s.$$

(3)...    1 cu. foot of mahogany weighs 1063 ounces

$$\begin{array}{c} \text{ft.} \quad \text{ft.} \quad \text{in.} \\ 10\tfrac{1}{2} \times 1\tfrac{1}{4} \times 2\tfrac{1}{4} = \tfrac{21}{2} \times \tfrac{5}{4} \times \tfrac{3}{16} = \tfrac{315}{128} \text{ cu. feet} \end{array}$$

$$1063 \times \tfrac{315}{128} = \tfrac{334845}{128} \text{ oz.} = 1 \text{ cwt. } 1 \text{ qr. } 23 \text{ lb. } 7\tfrac{125}{128} \text{ oz.}$$

(4).. 
gal.
25 fresh water, sp. gr. 1     = 25
30 sea   water, sp. gr. 1·0263 = 30·789
$\overline{55}$            55·789

sp. gr. of mixture = 55·789 ÷ 55
= 1·014345

(5)...55 mi. $-17\frac{1}{2}$ mi. $=37\frac{1}{2}$ miles ; 42 wks. $-14$ wks. $=28$ weeks

$$\text{men wks. \quad men wks. \quad mi. \quad mi.}$$
$$420 \times 14 \quad : \quad x \times 28 \quad :: \quad 17\frac{1}{2} \quad : \quad 37\frac{1}{2}$$

$$x = \frac{\overset{15}{\cancel{420}} \times \overset{2}{\cancel{14}} \times \overset{15}{\cancel{37\frac{1}{2}}}}{\underset{7}{\cancel{28} \times \cancel{17\frac{1}{2}}}} = 450 \text{ men}$$

Additional men required $= 450 - 420 = 30$

$$
\begin{array}{cc}
£ & s. \\
\end{array}
$$

(6)...
$$
\begin{array}{l}
\quad\quad 777 \ \ 12 = 1 \text{ year's interest} \\
\quad\quad\quad\quad 20 \\
\hline
6)\overline{15552} \quad 0 \text{ capital at end of 5th year} \\
\quad 2592 \quad 0 \text{ increase in 5th year} \\
\hline
6)\overline{12960} \quad 0 \text{ capital at end of 4th year} \\
\quad 2160 \quad 0 \text{ increase in 4th year} \\
\hline
6)\overline{10800} \quad 0 \text{ capital at end of 3rd year} \\
\quad 1800 \quad 0 \text{ increase in 3rd year} \\
\hline
6)\overline{9000} \quad 0 \text{ capital at end of 2nd year} \\
\quad 1500 \quad 0 \text{ increase in 2nd year} \\
\hline
6)\overline{7500} \quad 0 \text{ capital at end of 1st year} \\
\quad 1250 \quad 0 \text{ increase in 1st year} \\
\hline
£6250 \quad 0 \text{ original capital}
\end{array}
$$

(7)...
$$
\begin{array}{ll}
13\frac{1}{3} & 100 \\
\ \ 5\frac{1}{4} & 13\frac{1}{2} \quad\quad £\\
\hline
18\frac{3}{4} \ : & 86\frac{1}{2} \ :: \ 300 \ : \ \text{sum expended}
\end{array}
$$

$$\text{Sum expended} = \frac{\overset{2}{\cancel{4}}}{\underset{}{\cancel{75}}} \times \frac{173}{\cancel{2}} \times \frac{\overset{4}{\cancel{300}}}{1} = £1384$$

(8)...
$$\sqrt[3]{3456} - 7\sqrt[3]{686} + 5\sqrt[3]{1024} + 3\sqrt[3]{54}$$
$$= \sqrt[3]{1728 \times 3} - 7\sqrt[3]{343 \times 2} + 5\sqrt[3]{512 \times 2} + 3\sqrt[3]{27 \times 2}$$
$$= 12\sqrt[3]{2} - 49\sqrt[3]{2} + 40\sqrt[3]{2} + 9\sqrt[3]{2}$$
$$= 12\sqrt[3]{2}$$

(9)..        $\text{Sum of series} = \left\{ 2a + (n-1)d \right\} \dfrac{n}{2}$

$= (26 \times 1\frac{5}{8}) \frac{27}{2}$

$= 42\frac{1}{4} \times 13\frac{1}{2}$

$= 570\frac{3}{8}$

(10)...   14th term $= 7 + (14-1)5 = 7 + 65 = 72$

10th term $= 5\frac{1}{2} + (10-1)2\frac{1}{2} = 5\frac{1}{2} + 22\frac{1}{2} = 28$


*EXERCISE CXL.*


(1)...   $13^2$  :  $19^2$  ::  $\overset{\text{ac. ro. po.}}{3 \ \ 2 \ \ 31\frac{1}{2}} = \overset{\text{po.}}{591\frac{1}{2}}$  :  $x$

$x = \dfrac{361 \times \overset{3\frac{1}{2}}{\cancel{591\frac{1}{2}}}}{\cancel{169}} = 1263\frac{1}{2}$ po. $= 7$ ac. 3 ro. $23\frac{1}{2}$ po.


(2)...        $\frac{4}{5}$ min. $= \frac{4}{5}$ of $\frac{1}{60} = \frac{1}{75}$ hour

$\overset{\text{hr.}}{\frac{1}{75}}$  :  $\overset{\text{hr.}}{\frac{10}{21}}$  ::  $\overset{\text{mile}}{\frac{7}{10}}$  :  $x$

$x = \dfrac{\cancel{75}}{1} \times \dfrac{\overset{25}{\cancel{10}}}{\underset{3}{\cancel{21}}} \times \dfrac{7}{\cancel{10}} = 25$ miles


(3)...   $\dfrac{1}{5} + \dfrac{2}{9} + \dfrac{1}{6} + \dfrac{2}{7} = \dfrac{126 + 140 + 105 + 180}{630} = \dfrac{551}{630}$

$1 - \frac{551}{630} = \frac{79}{630}$

$\overset{}{\frac{79}{630}}$  :  $1$  ::  $\overset{\text{tr.}}{79}$  :  $630$ trees

$$\text{(4)...}\quad \begin{array}{c}\text{bu. mo. hrs.}\\7\times3\times5\end{array}\ :\ \begin{array}{c}\text{bu. mo. hrs.}\\11\times7\times7\end{array}\ ::\ \begin{array}{c}\text{cu. ft.}\\5880\end{array}\ :\ x$$

$$x = \frac{11\times 7\times 7\times 5880}{7\times 3\times 5} = 30184 \text{ cu. feet}$$

(with cancellation: $5880 \to 1960 \to 392$)

(5)...            £2  10s.÷1s.  6d. = $33\frac{1}{3}$

$$\frac{29}{17}\ :\ 1\ ::\ \overset{£}{33\tfrac{1}{3}}\ :\ \text{rent of house}$$

$$\text{Rent of house} = \frac{27}{20}\times\frac{100}{3} = £45 \text{ per annum}$$

$$\text{(6)...}\quad \begin{array}{l}73 \text{ lb. } 10 \text{ oz. at } 3s.\ 9d. \text{ per lb.} = \begin{array}{ccc}£ & s. & d.\\13 & 16 & 1\tfrac{1}{4}\end{array}\\ \qquad\qquad\qquad\qquad\ \text{Cost} = \begin{array}{ccc}12 & 5 & 5\end{array}\\ \qquad\qquad\qquad\qquad\ \text{Profit} = £1\ \overline{\ 10\quad 8\tfrac{1}{4}}\end{array}$$

$$\begin{array}{ccc}£ & s. & d.\\12 & 5 & 5\end{array}\ :\ \begin{array}{ccc}£ & s. & d.\\1 & 10 & 8\tfrac{1}{4}\end{array}\ ::\ 100\ :\ 12\tfrac{1}{2} \text{ per cent.}$$

(7)...The three parts will be in the following proportion :—

$$\begin{array}{rcl}3\times 6 & = & 18\\4\times 7 & = & 28\\5\times 8 & = & \underline{40}\\ & & 86\end{array}$$

$$86\ :\ 18\ ::\ 56\ :\ 11\tfrac{31}{43}$$

$$86\ :\ 28\ ::\ 56\ :\ 18\tfrac{10}{43}$$

$$86\ :\ 40\ ::\ 56\ :\ 26\tfrac{2}{43}$$

$$
\begin{array}{lrrr}
 & \pounds & s. & d. \\
\text{(8)}\ldots \quad \text{Cost of 25 yards} = & 9 & 7 & 6 \\
\text{Required profit, } \tfrac{1}{10} = & & 18 & 9 \\
\hline
 & 10 & 6 & 3 \\
\text{10 yds. at } 6s. \text{ per yd.} = & 3 & 0 & 0 \\
\end{array}
$$

$$25-10 = 15 \left\{ \begin{array}{r} 3)\ \overline{7\ \ 6\ \ 3} \\ 5)\ \overline{2\ \ 8\ \ 9} \\ \hline \end{array} \right.$$

$$9s.\ 9d.\ \text{per yard}$$

(9)...

$$\left(\frac{5}{8}\right)^{\frac{3}{2}} = \sqrt{\left(\frac{5}{8}\right)^3} = \sqrt{(\cdot 625)^3} = \sqrt{\cdot 244160625}$$

$$= \cdot 494105\ldots\ldots$$

(10)...    1.

$$\text{Sum} = \{2a+(n-1)d\}\frac{n}{2}$$

$$= \{118-(15\times 3)\}8$$

$$= 73\times 8$$

$$= 584$$

2.

$$\text{Sum} = \{2a+(n-1)d\}\frac{n}{2}$$

$$= \{33\tfrac{1}{2}-(16\times \tfrac{3}{4})\}\ \tfrac{17}{2}$$

$$= 21\tfrac{1}{2}\times 8\tfrac{1}{2}$$

$$= 182\tfrac{3}{4}$$

3.

$$\text{Sum} = \{2a+(n-1)d\}\ \frac{n}{2}$$

$$= \{39-(19\times 1\tfrac{1}{4})\}10$$

$$= 15\tfrac{1}{4}\times 10$$

$$= 152\tfrac{1}{2}$$

## EXERCISE CXLI.

(1)...

$$\frac{\sqrt{7+\frac{1}{5}}+\sqrt{6-\frac{6}{7}}}{\sqrt{7+\frac{1}{5}}\times\sqrt{6-\frac{6}{7}}} = \frac{\dfrac{6}{\sqrt{5}}+\dfrac{6}{\sqrt{7}}}{\dfrac{6}{\sqrt{5}}\times\dfrac{6}{\sqrt{7}}} = \frac{\dfrac{\sqrt{7}}{\sqrt{5}}}{\dfrac{36}{\sqrt{5}.\sqrt{7}}}$$

$$= \frac{\sqrt{7}\times\sqrt{5}\times\sqrt{7}}{36\times\sqrt{5}} = \frac{7}{36}$$

(2)...     $(5\frac{4}{9})^2 \times (\frac{3}{7} \text{ of } \frac{5}{14} \text{ of } 6\frac{3}{4})$

$$= \frac{\overset{7}{\cancel{49}}}{\cancel{9}}\times\frac{\overset{7}{\cancel{49}}}{\cancel{9}}\times\frac{3}{7}\times\frac{5}{\underset{2}{\cancel{14}}}\times\frac{\overset{3}{\cancel{27}}}{4} = \frac{245}{8} = 30\frac{5}{8}$$

$(3\frac{3}{5})^3 \div (\frac{8}{15} \text{ of } \frac{9}{20} \text{ of } 7\frac{5}{7})$

$$= \frac{\cancel{18}}{\cancel{5}}\times\frac{\overset{2}{\cancel{18}}}{\cancel{5}}\times\frac{\overset{6}{\cancel{18}}}{5}\times\frac{\overset{3}{\cancel{15}}}{\underset{2}{\cancel{8}}}\times\frac{\overset{4}{\cancel{20}}}{9}\times\frac{7}{\underset{3}{\cancel{54}}} = \frac{126}{5} = 25\frac{1}{5}$$

(3)...     $63+7 = 70$ gallons

$$
\begin{array}{lrrr}
 & \pounds & s. & d. \\
70 \text{ gallons at } 9s.\ 6d. = & 33 & 5 & 0 \\
\text{Cost} = & 27 & 11 & 3 \\
\text{Profit} = & \pounds 5 & 13 & 9
\end{array}
$$

$$
\begin{array}{ccc}
\pounds\ s.\ d. & \pounds\ s.\ d. & \\
27\ 11\ 3 \ : \ 5\ 13\ 9 \ :: \ 100 \ : \ 20\frac{40}{83} \text{ per cent.}
\end{array}
$$

(4)...

| £ | s. | da. | | £ | da. | | gui. | | gui. |
|---|----|-----|--|---|-----|--|------|--|------|
| 547 | 10 × 70 | | : | 657 × $x$ | | :: | 5 | : | 9 |
| 2 | | | | 2 | | | | | |
| 1095 | | | | 1314 | | | | | |

$$x = \frac{\cancel{1095} \times \cancel{70} \times \cancel{9}}{\cancel{1314} \times \cancel{5}} = 105 \text{ days}$$

(5)...

| | | £ | yr. | | |
|---|---|------|-----|---|------|
| | A | 6000 × 1 | = | | 6000 |
| | B | 5000 × $\frac{4}{5}$ | = | | 4000 |
| | C | 7000 × $\frac{3}{5}$ | = | | 4200 |
| | | | | | 14200 |

14200 : 6000 :: 2485 : 1050   A's share

14200 : 4000 :: 2485 : 700   B's share

14200 : 4200 :: 2485 : 735   C's share

(6)...

1 woman can do $\frac{7}{9}$ of the work of a man

1 boy      „    $\frac{7}{12}$    „       „

∴ 5 men + 6 women + 8 boys can do the work of

$(5 + 6 \cdot \frac{7}{9} + 8 \cdot \frac{7}{12} =)14\frac{1}{3}$ men

| men | | men | | da. | | |
|-----|---|-----|----|-----|---|---|
| $14\frac{1}{3}$ | : | 7 | :: | $4\frac{1}{2}$ | : | $x$ |

$$x = \frac{3}{43} \times \frac{7}{1} \times \frac{9}{2} = \frac{189}{86} = 2\frac{17}{86} \text{ days}$$

)... $\qquad 4\frac{1}{4} \quad : \quad 3\frac{1}{2} \quad :: \quad \overset{\pounds \quad s.}{1215 \ 10} \quad : \quad x$

$$x = \frac{\cancel{4}}{\cancel{17}} \times \frac{7}{\cancel{2}} \times \frac{\overset{143}{\cancel{2431}}}{\cancel{2}} = \pounds 1001$$

)... See *Exercise CXXXIII.* (8)

In this question the minute-hand has to gain $2\frac{1}{2}$ rounds

$$\overset{\text{ro.}}{11} \quad : \quad \overset{\text{ro.}}{2\frac{1}{2}} \quad :: \quad \overset{\text{hrs.}}{12} \quad : \quad \overset{\text{hrs.}}{2\tfrac{8}{11}} = \overset{\text{hrs. min.}}{2 \ 43\tfrac{7}{11}}$$

)...
$$321876944964(567342$$
$$25$$
$$\overline{106)\ \overline{718}}$$
$$636$$
$$\overline{1127)\ \overline{8276}}$$
$$7889$$
$$\overline{11343)\ \overline{38794}}$$
$$34029$$
$$\overline{113464)\ \overline{476549}}$$
$$453856$$
$$\overline{1134682)\ \overline{2269364}}$$
$$\underline{2269364}$$

$$432081216(756$$
$$343$$
$$7^2 \times 300 = 14700)\ \overline{89081}$$
$$\overline{73500} = 14700 \times 5$$
$$5250 = 7 \times 30 \times 5^2$$
$$125 = 5^3$$
$$\overline{78875} \quad \text{subtrahend}$$
$$75^2 \times 300 = 1687500)\overline{10206216}$$
$$\overline{10125000} = 1687500 \times 6$$
$$81000 = 75 \times 30 \times 6^2$$
$$216 = 6^3$$
$$\overline{10206216}$$

```
      36469158961(190969
       1
  29)264                              190969(437
     261                             16
3809)  36915                      83) 309
       34281                          249
   38186) 263489                 867) 6069
          229116                      6069
     381929) 3437361
            3437361
```

```
      34296447249(185193
       1
  28)242                              185193(57
     224                              125
365) 1896            5² × 300 = 7500) 60193
     1825                             52500 = 7500 × 7
3701) 7144                             7350 = 5 × 30 × 7²
      3701                              343 = 7³
  37029)344372                         60193
        333261
   370383) 1111149
           1111149
```

(10)...    Let $x$ = the price of a turkey, in pence

Then $\frac{3}{5}.x =$         „     goose,     „

$\frac{8}{25}.x =$       „     duck,      „

$\frac{6}{25}.x =$       „     fowl,      „

£21  17s.  6d. = 5250 pence

$24.x+30.\frac{3}{5}.x+50.\frac{8}{25}.x+50.\frac{6}{25}.x = 5250$

$24x+18x+16x+12x = 70x = 5250$

$x = 75d. = 6s. \ 3d.$, turkeys

$\frac{3}{5}.x = 45d. = 3s. \ 9d.$, geese

$\frac{8}{25}.x = 24d. = 2s. \ 0d.$, ducks

$\frac{6}{25}.x = 18d. = 1s. \ 6d.$, fowls

## *EXERCISE CXLII.*

(1)...The train from Holyhead has travelled $(40\frac{4}{5} \times \frac{1}{3} =)$ $13\frac{3}{5}$ miles when the other train leaves Chester

The trains approach each other at the rate of $40\frac{4}{5} + 18 = 58\frac{4}{5}$ miles per hour

Hence, they will pass each other in $\dfrac{85 - 13\frac{3}{5}}{58\frac{4}{5}} = \dfrac{17}{14}$ hours

Distance from Chester $= \overset{\text{mi.}}{18} \times \frac{17}{14} = \frac{153}{7} = 21\frac{6}{7}$ miles

(2)... $\sqrt[3]{5\frac{104}{125}} \times \sqrt{3\frac{6}{25}} = \sqrt[3]{\frac{729}{125}} \times \sqrt{\frac{81}{25}} = \frac{9}{5} \times \frac{9}{5} = \frac{81}{25} = 3\frac{6}{25}$

(3)... $\dfrac{\sqrt{11} + \sqrt{7}}{\sqrt{11} - \sqrt{7}} \times \dfrac{\sqrt{11} + \sqrt{7}}{\sqrt{11} + \sqrt{7}} = \dfrac{18 + 2\sqrt{77}}{4} = 4\frac{1}{2} + \frac{1}{2}\sqrt{77}$

$$= 4\frac{1}{2} + \frac{1}{2}(8\cdot 77496)$$

$$= 4\cdot 5 + 4\cdot 38748$$

$$= 8\cdot 88748$$

(4)...
$$\overset{\text{men da. hrs.}}{72 \times 9 \times 12} : \overset{\text{men da. hrs.}}{x \times 36 \times 9} :: \overset{\text{yds. ft. ft.}}{324 \times 36 \times 8} : \overset{\text{yds. ft. ft.}}{1458 \times 40 \times 9}$$

$$x = \frac{\overset{2}{72} \times 9 \times \overset{9}{12} \times \overset{5}{1458} \times \overset{3}{40} \times 9}{\underset{2}{\underset{}{36}} \times 9 \times \underset{3}{324} \times 36 \times 8} = 135 \text{ men}$$

$$
\begin{array}{lll}
 & £ & s. & d. \\
\end{array}
$$

(5)...   5 per cent. $= \frac{1}{20}$)525   0   0 $= 500$ guineas

                      26   5   0 int. for 1 year

                               2

                  £52  10   0 simple int. for 2 years

$$
\begin{array}{lll}
 & £ & s. & d. \\
\end{array}
$$

     5 per cent. $= \frac{1}{20}$|525   0   0

                   26   5   0 1st year's int.

       ,,       ,,   |551   5   0

                   27  11   3 2nd year's int.

                  578  16   3 amount in 2 years

                  525   0   0 principal

                   53  16   3 comp. int. for 2 years

                   52  10   0

         Difference $= $ £1   6   3

                  oz.   dwt.

(6)...               5739  12

      One-sixth $= $   956  12 allowance for waste

               4783   0

                 17s.   per ounce

           20)81311

             £4065  11s. duty on gold articles

                oz.   dwt.

            1032958  16

     One-sixth $= $  172159  16 allowance for waste

             860799

               18d.   per ounce

        12)15494382

        20)1291198   6

           64559  18   6 duty on silver articles

            4065  11   0    ,,    gold    ,,

          £68625   9   6 total amount of duty

                £   s.   d.

(7)...             68625   9   6

   Commission, $2\frac{1}{2}$ per cent. $= $  1715  12  $8\frac{17}{20}$

               £66909  16  $9\frac{3}{20}$

(8) ..    Let $x =$ the portion immersed, in inches

$$x \quad : \quad 9 \quad :: \quad \cdot852 \quad : \quad 1$$

$$x = 7\cdot668 \text{ inches}$$

(9)...    Let $x =$ the portion below the surface, in feet

then $(x+3\frac{1}{2})$ feet $=$ the whole thickness of the ice

$$x \quad : \quad x+3\tfrac{1}{2} \quad :: \quad \cdot930 \quad : \quad 1\cdot028$$

$$(1\cdot028)x = \cdot930(x+3\tfrac{1}{2})$$

$$= (\cdot930)x+3\cdot255$$

$$(\cdot098)x = 3\cdot255$$

$$x = 3\cdot255 \div \cdot098$$

$$= 33\tfrac{3}{14} \text{ feet}$$

(10)...    £45 + £54 + £55 10s. + £61 10s. = £216

| £216 | : | £45 | :: | 15s. | : | 3s. | 1½d. | A. |
|------|---|-----|-----|------|---|-----|------|----|
| £216 | : | £54 | :: | 15s. | : | 3s. | 9d. | B. |
| £216 | : | £55 10s. | :: | 15s. | : | 3s. | 10¼d. | C. |
| £216 | : | £61 10s. | :: | 15s. | : | 4s. | 3¼d. | D. |

### *EXERCISE CXLIII.*

(1)...

$$\frac{43}{57}-\frac{9}{17} = \frac{731-513}{969} = \frac{218}{969}$$

$$\frac{218}{969} \div 2 = \frac{109}{969}, \text{ smaller part}$$

$$\frac{109}{969}+\frac{9}{17} = \frac{109}{969}+\frac{513}{969} = \frac{622}{969}, \text{ larger part}$$

(2)... $\dfrac{\sqrt{13}-\sqrt{11}}{\sqrt{13}+\sqrt{11}} \times \dfrac{\sqrt{13}-\sqrt{11}}{\sqrt{13}-\sqrt{11}} = \dfrac{24 \cdot 2\sqrt{143}}{2} = 12-\sqrt{143}$

$$12-\sqrt{143} = 12-11\cdot95826$$

$$= \cdot04174$$

(3)...

|  |  |  | st. | ac. | ro. | per. | yds. |
|---|---|---|---|---|---|---|---|
| $(8)^2$ | : | $(5\frac{1}{2})^2$ | :: | 347 | 2 | 21 | $24\frac{3}{4}$ |
| 256 |  | 121 |  |  |  | $11\times11=121$ |

$$\begin{array}{c|cccc}
 & 3824 & 0 & 0 & 0 \\
 & & & & 11 \\
\hline
256\begin{cases} 8)\overline{42064} & 0 & 0 & 0 \\ 8)\overline{5258} & 0 & 0 & 0 \\ 4)\overline{657} & 1 & 0 & 0 \end{cases} & & & & \\
\hline
164 & 1 & 10 & 0
\end{array}$$

164 Cheshire acres, 1 rood, 10 perches

(4)...    $\frac{3}{4}$ of £65 = £48 15s.

|  | s. | d. |
|---|---|---|
| 2 poor-rates | 2 | 6 |
| Highway-rate |  | 6 |
| Church-rate |  | 3 |
|  | 3 | 3 in the pound |

|  | £ | s. | d. |
|---|---|---|---|
| 2s. = $\frac{1}{10}$ of £1 | 48 | 15 | 0 |
| 1s. = $\frac{1}{2}$ of 2s. | 4 | 17 | 6 |
| 3d. = $\frac{1}{4}$ of 1s. | 2 | 8 | 9 |
|  |  | 12 | $2\frac{1}{4}$ |
| Parochial rates | £7 | 18 | $5\frac{1}{4}$ |

$\frac{4}{5}$ of £65 = £52

House-tax = 9d. × 52 = £1 19s.

|  | £ | s. | d. |
|---|---|---|---|
| Annual rent ......... | 65 | 0 | 0 |
| Parochial rates ...... | 7 | 18 | $5\frac{1}{4}$ |
| House-tax ............ | 1 | 19 | 0 |
|  | £74 | 17 | $5\frac{1}{4}$ |

(5)... 10 ac. 2 ro. 6 per. $28\frac{1}{2}$ sq. yds. = 51030 square yards

men da. hrs.　　men da. hrs.　　yds. yds.　　　　yds.
$5 \times 6 \times 10\frac{1}{2}$ : $6 \times 7 \times x$ :: $252 \times 135 \times 3$ : $51030 \times 4$

$$x = \frac{5 \times \cancel{6} \times \cancel{10\frac{1}{2}}^{\overset{\textstyle 3}{\cancel{}}} \times \cancel{51030}^{\overset{\textstyle 403}{\cancel{}}} \times 4}{\cancel{6} \times \cancel{7} \times \cancel{252} \times \cancel{135} \times \cancel{3}} = 15 \text{ hours}$$

(6)...

$$\cdot 72323 \text{ &c.} = \frac{723 - 7}{990} = \frac{716}{990} = \frac{358}{495}$$

$$\cdot 94141 \text{ &c.} = \frac{941 - 9}{990} = \frac{932}{990} = \frac{466}{495}$$

$$\cdot 00735735 \text{ &c.} = \frac{735}{99900} = \frac{49}{6660}$$

(7)...　　　　$38\frac{1}{2}$ miles = 2439360 inches

2 ft. 11 in. $\times 3\frac{1}{7}$ = 110 inches, circumference of fore wheels

4 ft. 1 in. $\times 3\frac{1}{7}$ = 154 inches, circumference of hind wheels

$2439360 \div 110 = 22176$, revolutions by fore wheels

$2439360 \div 154 = 15840$, revolutions by hind wheels

(8)... See *Exercise CXXXVI.* (9)

$$\text{Number of days} = \frac{l - a + d}{d}$$
$$= \frac{37 - 17 + 4}{4}$$
$$= 6$$

$$\text{Distance from London to Buxton} = (a + l)\frac{n}{2}$$
$$= (17 + 37)3$$
$$= 54 \times 3$$
$$= 162 \text{ miles}$$

(9)...
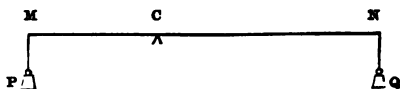


$$P : Q :: CN : CM$$
$$\therefore P \times CM = Q \times CN$$

here, CM = 16 in.; CN = 44−16 = 28 in.; Q = 12 lb.

$$P \times 16 = 12 \times 28$$

$$\therefore P = \frac{12 \times 28}{16} = 21 \text{ lb.}$$

(10)...
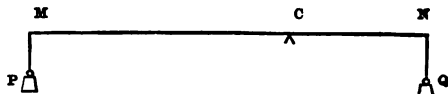


Here, CM = 22 in.; CN = 10 in.; Q = 55 lb.

$$P \times 22 = 55 \times 10$$

$$\therefore P = \frac{55 \times 10}{22} = 25 \text{ lb.}$$

*EXERCISE CXLIV.*

(1)...    April, May, and June, contain 91 days = 13 weeks

| per. wk. | | per. wks. | | oz. | | |
|---|---|---|---|---|---|---|
| 8×1 | : | 13×13 | :: | 14 | : | 18 lb. 7¾ oz. of tea |

| per. wk. | | per. wks. | | lb. | | |
|---|---|---|---|---|---|---|
| 8×1 | : | 13×13 | :: | 1¾ | : | 36 lb. 15½ oz. of coffee |

| per. wk. | | per. wks. | | lb. | | |
|---|---|---|---|---|---|---|
| 8×1 | : | 13×13 | :: | 3 | : | 63 lb. 6 oz. of lump sugar |

| per. wk. | | per. wks. | | lb. | | |
|---|---|---|---|---|---|---|
| 8×1 | : | 13×13 | :: | 4 | : | 84½ lb. of moist sugar |

(2)... $94\frac{3}{5}$ : $x$ :: $x$ : 212

$$\therefore x^2 = 94\frac{3}{5} \times 212$$

$$= \tfrac{179776}{9}$$

$$x = \tfrac{424}{3} = 141\tfrac{1}{3}$$

$71.6$ : $x$ :: $x$ : $161.1$

$$\therefore x^2 = 71.6 \times 161.1$$

$$= 11534.76$$

$$x = 107.4$$

(3)... $\dfrac{13+\sqrt{18\frac{7}{9}}}{\sqrt{7\frac{11}{25}}-1\frac{2}{3}} + \dfrac{\sqrt{18\frac{13}{49}}-\sqrt{5\frac{1}{16}}}{6\frac{1}{4}+2\frac{4}{7}} = \dfrac{13+4\frac{1}{3}}{2\frac{4}{5}-1\frac{2}{3}} + \dfrac{4\frac{2}{7}-2\frac{1}{4}}{6\frac{1}{4}+2\frac{4}{7}}$

$$= \dfrac{17\frac{1}{3}}{1\frac{2}{15}} + \dfrac{2\frac{1}{28}}{8\frac{23}{28}}$$

$$= \tfrac{260}{17} \times \tfrac{13}{3}$$

$$= \tfrac{3380}{51} = 66\tfrac{14}{51}$$

(4)...See *Exercise CXXXIV.* (5)

$$30° \text{ C.} = \tfrac{9}{5}.30°+32° = 54°+32° = 86° \text{ F.}$$

$$78.35° \text{ F.} = \tfrac{5}{9}(78.35°-32°) = \tfrac{5}{9}(46.35°) = 25.75° \text{ C.}$$

Temperature at Paris    30°   C. = 86°   F.
     „      „   London 25.75° C. = 78.35° F.
Difference of temperature   $\overline{4.25° \text{ C.}}$ = $\overline{7.65° \text{ F.}}$

(5)... $14°$ F. $= \tfrac{5}{9}(14°-32°) = \tfrac{5}{9}(-18°) = -10°$ C.

(6)... $-15°$ C. $= \tfrac{9}{5}(-15°)+32° = -27°+32° = 5°$ F.

A A

(7)...The hands are at right angles to each other *twice* between 1 and 2 o'clock, viz. when the minute-hand has gained $1\frac{1}{4}$ rounds, and again, when it has gained $1\frac{3}{4}$ rounds.

$$\overset{\text{ro.}}{11} \; : \; \overset{\text{ro.}}{1\frac{1}{4}} \; :: \; \overset{\text{hrs.}}{12} \; : \; 1 \text{ hr. } 21\tfrac{9}{11} \text{ min.}$$

$$\overset{\text{ro.}}{11} \; : \; \overset{\text{ro.}}{1\frac{3}{4}} \; :: \; \overset{\text{hrs.}}{12} \; : \; 1 \text{ hr. } 54\tfrac{6}{11} \text{ min.}$$

(8)...   $\overset{\text{men}}{(6\times5)}+\overset{\text{wo.}}{(8\times3)}+\overset{\text{b.}}{(10\times2)} = 30+24+20 = 74$

$\overset{\text{men}}{(10\times5)}+\overset{\text{wo.}}{(6\times3)}+\overset{\text{b.}}{(12\times2)} = 50+18+24 = 92$

$$\overset{\text{da.}}{74\times25} \; : \; \overset{\text{da.}}{92\times x} \; :: \; 1 \; : \; 2$$

$$x = \frac{\overset{37}{\cancel{74}} \times 25 \times \cancel{2}}{\underset{\underset{23}{\cancel{46}}}{\cancel{92}}} = \frac{925}{23} \text{ da.} = 40\tfrac{5}{23} \text{ days}$$

(9)...

|  | £ | s. | d. |
|---|---|---|---|
| 5 per cent. $= \frac{1}{20}$ | 346 | 12 | 6 |
| $\frac{1}{2}$  ,,   $= \frac{1}{10}$ | 17 | 6 | $7\frac{1}{2}$ |
|  | 1 | 14 | $7\frac{18}{20}$ |
| 2 mo. $= \frac{1}{6}$ of 1 yr. | 19 | 1 | $3\tfrac{9}{20}$ int. for 1 year |
|  | £3 | 8 | $6\tfrac{23}{40}$ bank discount |

Amount of £100 for 2 months at $5\frac{1}{2}$ per cent. per annum
$= £100+(£5\frac{1}{2}\times\frac{1}{6}) = £100 \ 18s. \ 4d.$

$$\overset{£ \quad s. \quad d.}{100 \ 18 \ 4} \; : \; \overset{£ \quad s. \quad d.}{346 \ 12 \ 6} \; :: \; \overset{s. \quad d.}{18 \ 4} \; : \; £3 \ 2s. \ 11\tfrac{785}{13711}d.$$

|  | £ | s. | d. |
|---|---|---|---|
| Bank discount | 3 | 3 | $6\tfrac{23}{40}$ |
| True discount | 3 | 2 | $11\tfrac{785}{13711}$ |
| Difference ... |  |  | $6\tfrac{14893}{43440}$ |

(10)...

|  | £ | s. | d. |
|---|---|---|---|
| 21)607 | 15 | 0¾ |  |

$$
\begin{array}{r|lll}
 & £ & s. & d. \\
21 & 607 & 15 & 0\frac{3}{4} \\
 & 28 & 18 & 9\frac{3}{4} \text{ int. for 4th year} \\
\hline
21 & 578 & 16 & 3 \\
 & 27 & 11 & 3 \text{ int. for 3rd year} \\
\hline
21 & 551 & 5 & 0 \\
 & 26 & 5 & 0 \text{ int. for 2nd year} \\
\hline
21 & 525 & 0 & 0 \\
 & 25 & 0 & 0 \text{ int. for 1st year} \\
\hline
 & £500 & 0 & 0
\end{array}
$$

## EXERCISE CXLV.

(1)...
$$
\begin{array}{ccccccc}
\text{yds.} & & \text{yds.} & & £ \ \ s. \ \ d. & & £ \\
34\frac{1}{2} & : & 29\frac{3}{4} & :: & 8 \ 12 \ \ 6 = 8\frac{1}{2} & : & x
\end{array}
$$

$$
x = \frac{7}{99} \times \frac{119}{\underset{2}{4}} \times \frac{99}{8} = £\frac{119}{16} = £7 \ 8s. \ 9d.
$$

(2)...
|  |  |  | s. | d. |  | s. | d. |
|---|---|---|---|---|---|---|---|
| 14¾ lb. | Beef | ............... | 0 | 8 | = | 9 | 10 |
| 9¼ " | Mutton | ............. | 0 | 7½ | = | 5 | 11¼ |
| 10¼ " | Pork | ............... | 0 | 7 | = | 5 | 11¾ |
| 3 | Loaves | ............. | 0 | 6½ | = | 1 | 7½ |
|  | Vegetables | ...... |  |  |  | 2 | 3 |
| 2 | Plum-puddings | 2 | 3 | = | 4 | 6 |
| 3 | Apple-pies | ...... | 1 | 6 | = | 4 | 6 |
| 2½ lb. | Cheese | ............. | 0 | 9 | = | 1 | 10½ |
|  | Sundries | ......... |  |  |  |  | 9 |
|  |  |  |  |  | £1 | 17 | 3 |

|  | £ | s. | d. |
|---|---|---|---|
| 28 half-crowns ... = | 3 | 10 | 0 |
| Cost of dinner ... = | 1 | 17 | 3 |
| Landlord's profit = | £1 | 12 | 9 |

▲ ▲ 2

<br>

$$
\begin{array}{lll}
 & \pounds & s. \quad d. \\
(3)\dots\ \text{4 cwt. 1 qr. 14 lb. at } 34s.\text{ per cwt.} = & 7 & 8 \quad 9 \\
\text{3 cwt. 2 qrs. 21 lb. } \text{,,} \ \ 36s.\ \text{,,} \quad \text{,,} \ = & 6 & 12 \quad 9 \\
\underline{\text{5 cwt. 1 qr.} \qquad\qquad \text{,,} \ \ 40s.\ \text{,,} \quad \text{,,} \ =\ 10} & 10 & 0 \\
\overline{\text{13 cwt. 1 qr. 7 lb.}} \qquad\qquad\qquad \pounds 24 & 11 & 6
\end{array}
$$

$$
\begin{array}{rll}
 & \pounds \quad s. \quad d. \\
\text{13 cwt. 1 qr. 7 lb. at } 5d.\text{ per lb.} = & 31 \quad 1 \quad 3 \\
\text{Cost} = & 24 \quad 11 \quad 6 \\
\text{Profit} = & \pounds 6 \quad 9 \quad 9
\end{array}
$$

$$
\begin{array}{ccc}
\pounds \quad s. \quad d. & \quad \pounds \quad s. \quad d. \\
24 \quad 11 \quad 6 \ : \ 6 \quad 9 \quad 9 \ :: \ 100 \ : \ 26\tfrac{3 0 0}{8 5 5}\text{ per cent.}
\end{array}
$$

$$(4)\dots \qquad \frac{4}{9}+\frac{3}{20}+\frac{4}{15} = \frac{80+27+48}{180} = \frac{155}{180} = \frac{31}{36}$$

$$1-\tfrac{31}{36} = \tfrac{5}{36}$$

$$\tfrac{5}{36} \ : \ 1 \ :: \ 175 \ : \ 1260,\ \text{number present}$$

$$
\begin{array}{lll}
 & s. \quad d. & \pounds \quad s. \quad d. \\
\tfrac{4}{9}\text{ of } 1260 = 560 \text{ at } 5 \ 0 = & 140 \quad 0 \quad 0 \\
\tfrac{3}{20}\text{ of } 1260 = 189 \text{ at } 3 \ 6 = & 33 \quad 1 \quad 6 \\
\tfrac{4}{15}\text{ of } 1260 = 336 \text{ at } 2 \ 6 = & 42 \quad 0 \quad 0 \\
\qquad\qquad\qquad 175 \text{ at } 1 \ 0 = & 8 \quad 15 \quad 0 \\
\text{Total receipts} = \pounds 223 & 16 \quad 6
\end{array}
$$

$$(5)\dots\frac{47}{84}\text{ guinea} = \frac{47}{\underset{4}{\cancel{84}}} \times \frac{\cancel{21}}{1} = \frac{47}{4}s. \quad = 11s.\ 9d.$$

$$\frac{17}{48}\text{ cwt.} = \frac{17}{\underset{12}{\cancel{48}}} \times \frac{\cancel{4}}{1} = \frac{17}{12}\text{ qrs.} = 1\text{ qr. 11 lb. } 10\tfrac{2}{3}\text{ oz.}$$

$$\frac{25}{64}\text{ mile} = \frac{25}{\underset{8}{\cancel{64}}} \times \frac{\cancel{8}}{1} = \frac{25}{8}\text{ fur.} = 3\text{ fur. } 27\tfrac{1}{2}\text{ yds.}$$

$$\frac{43}{60}\text{ acre} = \frac{43}{\underset{15}{\cancel{60}}} \times \frac{\cancel{4}}{1} = \frac{43}{15}\text{ ro.} = 2\text{ ro. 34 po. } 20\tfrac{1}{5}\text{ yds.}$$

$$\frac{7}{36} \text{ cu. yd.} = \frac{7}{\overset{\underset{\displaystyle 3}{\cancel{36}}}{4}} \times \frac{\overset{3}{\cancel{27}}}{1} = \frac{21}{4} \text{ c. ft.} = 5 \text{ cu. ft. } 432 \text{ cu. in.}$$

$$\frac{33}{50} \text{ week} = \frac{33}{50} \times \frac{7}{1} = \frac{231}{50} \text{ da.} = 4 \text{ da. } 14 \text{ ho. } 52 \text{ min. } 48 \text{ sec.}$$

(6)...
$$
\begin{array}{r}
6)7543 \\
\hline
6)\overline{1257}......1 \\
6)\overline{209}......3 \\
6)\overline{34}......5 \\
\hline
5......4
\end{array}
$$

$$(7543)_{10} = (54531)_6$$

(7)...
$$
\begin{array}{r}
113210313 \\
4 \\
\hline
5 \\
4 \\
\hline
23 \\
4 \\
\hline
94 \\
4 \\
\hline
377 \\
4 \\
\hline
.\ \overline{1508} \\
4 \\
\hline
6035 \\
4 \\
\hline
24141 \\
4 \\
\hline
96567
\end{array}
$$

Or thus, $(113210313)_4 = 1.4^8 + 1.4^7 + 3.4^6 + 2.4^5 + 1.4^4$
$$+ 3.4^2 + 1.4 + 3$$
$$= 65536 + 16384 + 12288 + 2048$$
$$+ 256 + 48 + 4 + 3$$
$$= (96567)_{10}$$
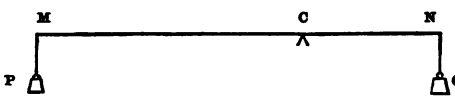
(8)...          $(42314)_5 = 4.5^4 + 2.5^3 + 3.5^2 + 1.5 + 4$
                $= 2500 + 250 + 75 + 5 + 4$
                $= (2834)_{10}$

Then,     7)2834
          $\overline{7)404}$......6
            $\overline{7)57}$......5
            · $\overline{7)8}$......1
              $\overline{1}$......1

∴ $(42314)_5 = (2834)_{10} = (11156)_7$

|  |  |
|---|---|
| 542130234 | 542130234 |
| 435125354 | 435125354 |
| sum, $\overline{1421300032}$ | difference, $\overline{103000440}$ |

(9)...



CM=25 in.; CN=13 in.; let P=$x$ lb.; then Q=(95−$x$) lb.
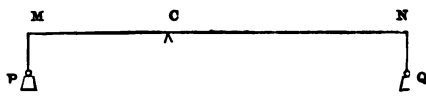
$$25 x = 13(95 - x)$$
$$= 1235 - 13x$$
$$38 x = 1235$$
$$x = 32\tfrac{1}{2} \text{ lb.}$$
$$95 - x = 62\tfrac{1}{2} \text{ lb.}$$

the weights are $32\tfrac{1}{2}$ lb. and $62\tfrac{1}{2}$ lb. respectively.

(10)...



Let CM=$x$ in.; then CN = (16−$x$) in.; P=15 lb.; Q=9 lb.

$$15 x = 9(16 - x)$$
$$= 144 - 9x$$
$$24 x = 144$$
$$x = 6 \text{ inches}$$
$$16 - x = 10 \text{ inches}$$

∴ the fulcrum is 6 inches from P, the greater weight.

## EXERCISE CXLVI.

(1)... $\frac{2}{3} - \frac{1}{2} = \frac{1}{6}$

$\frac{1}{6}$ : 1 :: £11 13s. 4½d. : £70 0s. 3d.

(2)... $17 \cdot 51375 = 17\frac{411}{800}$

$3\frac{3}{8}$ : $17\frac{411}{800}$ :: $11\frac{13}{16}$ : $x$

$$x = \frac{\cancel{8}}{\cancel{27}} \times \frac{14011}{\cancel{800}} \times \frac{\cancel{189}^{7}}{16} = \frac{98077}{1600} = 61\frac{477}{1600} = 61 \cdot 298125$$

$9\frac{3}{5}$ : $x$ :: $x$ : $153\frac{3}{5}$

$$x^2 = 9\frac{3}{5} \times 153\frac{3}{5}$$

$$= \frac{48}{5} \times \frac{768}{5}$$

$$= \frac{36864}{25}$$

$$x = \frac{192}{5} = 38\frac{2}{5}$$

(3)... $\sqrt{51\frac{13}{36}} = \sqrt{\frac{1849}{36}} = \frac{43}{6} = 7\frac{1}{6}$

$\sqrt[3]{2\frac{314}{343}} = \sqrt[3]{\frac{1000}{343}} = \frac{10}{7} = 1\frac{3}{7}$

(4)... Sum gained by expending £3 17s. 9d. = 1½d.

| d. | | d. | | £ | s. | d. | d. | | |
|---|---|---|---|---|---|---|---|---|---|
| 1½ | : | 240 | :: | 3 | 17 | 9 = | 933 | : | $x$ |
| 2 | | 2 | | | | | | | |
| 3 | | 480 | | | | | | | |

$$x = \frac{\cancel{480}^{160} \times 933}{\cancel{3}} = 149280d. = £622$$

(5)...
men   w.       b.               men

$$5 + (3 \times \tfrac{2}{3}) + (4 \times \tfrac{3}{4} \times \tfrac{2}{3}) = 5 + 2 + 2 = 9$$

men da. hrs.     men da. hrs.     ac.      ac.

$$4 \times 4\tfrac{1}{2} \times 14 \;:\; 9 \times 5\tfrac{1}{3} \times x \;::\; 5\tfrac{1}{4} \;:\; 13\tfrac{1}{2}$$

$$x = (4 \times 4\tfrac{1}{2} \times 14 \times 13\tfrac{1}{2}) \div (9 \times 5\tfrac{1}{3} \times 5\tfrac{1}{4})$$

$$= \frac{\cancel{4}}{1} \times \frac{9}{\cancel{2}} \times \frac{\overset{2}{\cancel{14}}}{1} \times \frac{27}{2} \times \frac{1}{\cancel{9}} \times \frac{\cancel{3}}{\cancel{16}} \times \frac{\cancel{4}}{\underset{3}{\cancel{21}}}$$

$$= \tfrac{27}{2} = 13\tfrac{1}{2} \text{ hours}$$

(6)...
```
          32103
          23213
         ------
         222321
          32103
         130212
         222321
         130212
       ------------
       (2211332211)₄
```

$$(2211332211)_4 = 2.4^9 + 2.4^8 + 1.4^7 + 1.4^6 + 3.4^5$$
$$+ 3.4^4 + 2.4^3 + 2.4^2 + 1.4 + 1$$

$$= 524288 + 131072 + 16384 + 4096$$
$$+ 3072 + 768 + 128 + 32 + 4 + 1$$

$$= (679845)_{10}$$

(7)...
```
4312)324400041031(34120423
     23441
     -----
     34440
     33303
     -----
     11320
      4312
     -----
     20034
     14124
     -----
     41010
     33303
     -----
     22023
     14124
     -----
     23441
     23441
```

$$6212432464(64352$$
$$51$$
$$154)\overline{1112}$$
$$1012$$
$$1613)\ \overline{10043}$$
$$5442$$
$$16165)\ \overline{130124}$$
$$123254$$
$$161732)\ \ \overline{354064}$$
$$354064$$

(8)...
$$\overset{£}{76}\ :\ \overset{£}{1558}\ ::\ \overset{£\ \ s.}{3\ \ \ 5}\ :\ \overset{£\ \ s.\ \ d.}{66\ 12\ \ 6}$$

$$\overset{£}{82}\ :\ \overset{£}{1558}\ ::\ \overset{£\ \ s.}{3\ \ 10}\ :\ \overset{£\ \ s.}{66\ 10}$$

£1558 invested in the 3¼ per cents. at 76, will yield 2s. 6d. per annum more than the same sum invested in the 3½ per cents. at 82.

(9)...  Common difference $= \dfrac{l-a}{m+1} = \dfrac{9\frac{1}{8}-5\frac{3}{4}}{8+1} = \dfrac{3\frac{3}{8}}{9} = \dfrac{3}{8}$

∴ the means are 6⅛, 6½, 6⅞, 7¼, 7⅝, 8, 8⅜, 8¾

Common difference $= \dfrac{l-a}{m+1} = \dfrac{78-13}{12+1} = \dfrac{65}{13} = 5$

∴ the means are 18, 23, 28, 33, 38, 43, 48, 53, 58, 63, 68, 73

(10)...  24 pints of sulphuric acid, sp. gr. 1·85 = 44·4
5   „   water   sp. gr. 1   =  5·0
       ‾‾‾‾
       49·4

Specific gravity of mixture = 49·4÷27·5 = 1·7963

*EXERCISE CXLVII.*

(1)...           1 mètre = 39·37079 inches
                           1000
        1 kilomètre = $\overline{39370·79}$ inches
                           507
                        $\overline{27559553}$
                        19685395
                   12)$\overline{19960990·53}$
                    3)$\overline{1663415·8775}$
               1760)$\overline{554471·9591}$(315 miles
                    5280
                   $\overline{2647}$
                    1760
                   $\overline{8871}$
                    8800
                   $\overline{71·9591}$ yards

distance = 315 miles, 71·9591 yds.


(2)...    Let $x$ = the number of shots fired by each

$$\tfrac{2}{3}.x + \tfrac{5}{6}.x + \tfrac{3}{8}.x = 45$$

$$6x + 20x + 9x = 1080$$

$$45x = 1080$$

$$\therefore x = 24$$


(3)...   Here, the minute-hand has to gain $5\tfrac{1}{6}$ rounds

| ro. | | ro. | | hrs. | | hrs. | min. | sec. |
|---|---|---|---|---|---|---|---|---|
| 11 | : | $5\tfrac{1}{6}$ | :: | 12 | : | 5 | 38 | $10\tfrac{10}{11}$ |

(4)... From 8 A.M. to 6 P.M. $=$ 10 hours

The rate of walking *decreases* $\frac{1}{4}$ mile per hour

$$s = \left\{ 2a + (n-1)d \right\} \frac{n}{2}$$
$$= \{9 - (9 \times \tfrac{1}{4})\}\, 5$$
$$= (9 - 1\tfrac{1}{4})\, 5$$
$$= 7\tfrac{1}{4} \times 5 = 36$$

$\therefore$ the person will have walked 36 miles in the given time.

(5)... $2s.\ 6d. \times 52 \times 14 = \pounds91$, annual rental

$$\begin{array}{ccccccc} \pounds & & \pounds & & \pounds & & \pounds \\ 7 & : & 91 & :: & 100 & : & 1300 \end{array}$$

(6)... 5 per cent. $= \frac{1}{20}$

| | | | £ | s. | d. |
|---|---|---|---|---|---|
| | | | 8000 | 0 | 0 |
| | | | 400 | 0 | 0 |
| ,, | ,, | ,, | 8400 | 0 | 0 |
| | | | 420 | 0 | 0 |
| ,, | ,, | ,, | 8820 | 0 | 0 |
| | | | 441 | 0 | 0 |
| ,, | ,, | ,, | 9261 | 0 | 0 |
| | | | 463 | 1 | 0 |
| ,, | ,, | ,, | 9724 | 1 | 0 |
| | | | 486 | 4 | $0\frac{3}{5}$ |
| ,, | ,, | ,, | 10210 | 5 | $0\frac{3}{5}$ |
| | | | 510 | 10 | $3\frac{3}{100}$ |
| ,, | ,, | ,, | 10720 | 15 | $3\frac{63}{100}$ |
| | | | 536 | 0 | $9\frac{363}{2000}$ |

Amount in 7 years £11256 16 $0\frac{1623}{2000}$

(7)... $\dfrac{\sqrt{7}+\sqrt{5}}{\sqrt{7}-\sqrt{5}} \times \dfrac{\sqrt{7}+\sqrt{5}}{\sqrt{7}+\sqrt{5}} = \dfrac{12+2\sqrt{35}}{2} = 6 + \sqrt{35}$

$$= 6 + 5{\cdot}916079$$
$$= 11{\cdot}916079$$

(8)...
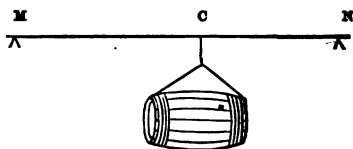


CM = 24 inches ; CN = 18 inches

Let $x$ lb. = weight borne by the man at M

then $(350-x)$ lb. =   „      „      „      „      N

$$24.x = 18(350-x)$$
$$= 6300-18x$$
$$42.x = 6300$$

$$\therefore x = 150 \text{ lb.}$$
$$350-x = 200 \text{ lb.}$$

Weight borne by the man at M = 150 lb.

     „          „          „      N = 200 lb.

(9)...In the solution of questions in Geometrical Progression the following notation will be used ·

$a$ = the first term

$r$ = the common ratio

$l$ = the last term

$m$ = the number of means

$n$ = the number of terms

$s$ = the sum of the series

1.    Sum of series $= \dfrac{a(r^n-1)}{r-1}$

$$= \frac{5(3^7-1)}{3-1}$$

$$= \frac{5(2187-1)}{2}$$

$$= 5465$$

2.     $\text{Sum} = \dfrac{a(r^n - 1)}{r - 1}$

$= \dfrac{7(4^8 - 1)}{4 - 1}$

$= \dfrac{7(65536 - 1)}{3}$

$= 152915$

3.  When $r$ is less than unity, it is more convenient to use the following formula :

$s = \dfrac{a(1 - r^n)}{1 - r}$

$= \dfrac{64\{1 - (\frac{1}{2})^{12}\}}{1 - \frac{1}{2}}$

$= \dfrac{64(1 - \frac{1}{4096})}{\frac{1}{2}}$

$= \dfrac{64 \cdot \frac{4095}{4096}}{\frac{1}{2}}$

$= \frac{4095}{32} = 127\frac{31}{32}$

(10)...     $\text{9th term} = ar^{n-1}$

$= 2 \times 3^8$

$= 2 \times 6561$

$= 13122$

12288 is the seventh term of a series, whose first term is 3 ;

$\therefore 12288 = 3 . r^6$

$r^6 = \frac{12288}{3}$

$= 4096$

and $r = 4$

$\therefore$ the means are 12, 48, 192, 768, 3072

## EXERCISE CXLVIII.

(1)...The two trains together traverse $52\frac{1}{2}$ miles in an hour: their united length is 462 feet

$$52\frac{1}{2} \text{ miles} = 277200 \text{ feet}$$

$$\begin{array}{ccccccc} \text{ft.} & & \text{ft.} & & \text{hr.} & & \text{sec.} \\ 277200 & : & 462 & :: & 1 & : & 6 \end{array}$$

i.e. the trains will have passed each other in 6 seconds.

*Proof* :—

The slow train will pass over $162\frac{4}{5}$ feet in 6 seconds
The fast    ,,    ,,    ,,  $299\frac{1}{5}$  ,,    ,,    ,,
United length of trains... $= \overline{462 \text{ feet}}$

(2)...From 8 A.M. on Thursday to 10 P.M. on the following Wednesday $= 158$ hours: in this time the clock has gained $4\frac{1}{2} + 3\frac{2}{5} = 7\frac{9}{10}$ minutes. The question, therefore, is, in how many hours did it gain $4\frac{1}{2}$ minutes ?

$$\begin{array}{ccccccc} \text{min.} & & \text{min.} & & \text{hrs.} & & \text{hrs.} \\ 7\frac{9}{10} & : & 4\frac{1}{2} & :: & 158 & : & x \end{array}$$

$$x = \frac{10}{79} \times \frac{9}{2} \times \frac{\overset{2}{\cancel{158}}}{1} = 90 \text{ hours}$$

The clock therefore showed the right time 90 hours after 8 A.M. on Thursday, i.e. at 2 P.M. on Monday.

(3)... 19th term $= 11 + (19-1)7 = 11 + 126 = 137$

$$\text{sum} = (a+l)\frac{n}{2}$$
$$= (11+137)\frac{19}{2}$$
$$= 148 \times 9\frac{1}{2}$$
$$= 1406$$

(4)... $(543214)_6 = 5.6^5 + 4.6^4 + 3.6^3 + 2.6^2 + 1.6 + 4$
$$= 38880 + 5184 + 648 + 72 + 6 + 4$$
$$= (44794)_{10}$$

$(75646328)_9 = 7.9^7 + 5.9^6 + 6.9^5 + 4.9^4 + 6.9^3 + 3.9^2$
$$+ 2.9 + 8$$
$$= 33480783 + 2657205 + 354294$$
$$+ 26244 + 4374 + 243 + 18 + 8$$
$$= (36523169)_{10}$$

Then,

```
3)36523169
3)12174389......2
3)4058129......2
3)1352709......2
3)450903......0
3)150301......0
3)50100......1
3)16700......0
3)5566......2
3)1855......1
3)618......1
3)206......0
3)68......2
3)22......2
3)7......1
2......1
```

$(75646328)_9 = (36523169)_{10} = (2112201120100222)_3$

Or, the transformation may be performed by one operation, bearing in mind that the digits in 75646328 increase from right to left in a nine-fold proportion :

$$
\begin{array}{r}
3)\overline{75646328}\phantom{....0} \\
3)\overline{24815108}......2 \\
3)\overline{7564632}......2 \\
3)\overline{2481510}......2 \\
3)\overline{756463}......0 \\
3)\overline{248151}......0 \\
3)\overline{75646}......1 \\
3)\overline{24815}......0 \\
3)\overline{7564}......2 \\
3)\overline{2481}......1 \\
3)\overline{756}......1 \\
3)\overline{248}......0 \\
3)\overline{75}......2 \\
3)\overline{24}......2 \\
3)\overline{7}......1 \\
2......1
\end{array}
$$

$(75646328)_9 = (2112201120100222)_3$

(5)...

$$
\begin{array}{cc}
 & 14d. \\
\underline{5d.} & \underline{18d.} \\
4\ \text{lb.} & 9\ \text{lb.}
\end{array}
$$

∴ there must be 9 lb. of coffee to every 4 lb. of chicory

$$
\begin{array}{cccccc}
\text{lb.} & & \text{lb.} & & \text{lb.} & \text{lb.} \\
4 & : & 9 & :: & 10 & : & 22\tfrac{1}{2}\ \text{of coffee}
\end{array}
$$

(6)...        Reduce the prices to sixpences

$$
\begin{array}{ccc}
 & 34 & \\
30 & 33 & 37 \\
\overline{\phantom{0}3\phantom{0}} & \overline{\phantom{0}3\phantom{0}} & \overline{\phantom{0}4\phantom{0}} \\
 & & 1 \\
\overline{3\ \text{gal.}} & \overline{3\ \text{gal.}} & \overline{5\ \text{gal.}}
\end{array}
$$

3 gallons at 15s. ; 3 gallons at 16s. 6d. ; and 5 gallons at 18s. 6d. or any multiples of these quantities.

*Proof.*

|  |  |  |  | s. | d. |
|---|---|---|---|---|---|
| 3 gallons at 15s. 0d. | = | 45 | 0 |
| 3 „ „ 16s. 6d. | = | 49 | 6 |
| 5 „ „ 18s. 6d. | = | 92 | 6 |
| 11 |  | 187 | 0 |

11 gallons at 17s. = 187s.

(7)...
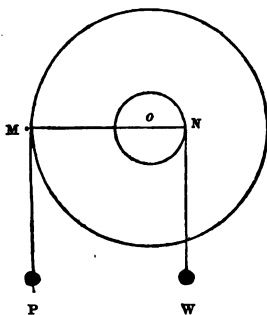


P  :  W  ::  radius of axle  :  radius of wheel

$$\text{P} \quad : \quad \underset{\text{lb.}}{60} \quad :: \quad \underset{\text{in.}}{4} \quad : \quad \underset{\text{in.}}{15}$$

$$\text{P} = \frac{60 \times 4}{15} = 16 \text{ lb.}$$

(8)...See figure in preceding example.

P  :  W  ::  radius of axle  :  radius of wheel

$$\underset{\text{lb.}}{21} \quad : \quad \underset{\text{lb.}}{90} \quad :: \quad \underset{\text{in.}}{3\tfrac{1}{2}} \quad : \quad x$$

$$\text{Radius of wheel} = \frac{90 \times 3\tfrac{1}{2}}{21} = 15 \text{ inches}$$

B B

<table>
<tr><td></td><td></td><td>oz.</td><td>dwt.</td><td>grs.</td></tr>
</table>

(9)...        · Weight in air ... = 3   17   21
            · Weight in water = 3   10   11
            Weight lost...... =  ‾7‾  ‾10‾

weight lost : whole weight :: sp. gr. of fluid : sp. gr. of body

dwt. grs.        dwt. grs.
  7   10   :   77   21   ::   1   :   sp. gr. of silver
  24            24
 ‾178‾         ‾1869‾

sp. gr. of silver = $\frac{1869}{178}$ = 10·5

(10)...Find three numbers which have the same ratio to each
        other as the required numbers;

Let 1 be the first

then $\frac{1}{3} \div \frac{1}{5} = \frac{5}{3}$ will be the second

and $\frac{1}{3} \div \frac{1}{7} = \frac{7}{3}$ will be the third

$1 + \frac{5}{3} + \frac{7}{3} = 5$

5   :   1   ::   90   :   18⎤
5   :   $\frac{5}{3}$   ::   90   :   30⎬the required parts
5   :   $\frac{7}{3}$   ::   90   :   42⎦


## EXERCISE CXLIX.

(1)...        The first four square numbers are 1, 4, 9, 16

The reciprocals of these are 1, $\frac{1}{4}$, $\frac{1}{9}$, $\frac{1}{16}$

$1 + \frac{1}{4} + \frac{1}{9} + \frac{1}{16} = \frac{144}{144} + \frac{36}{144} + \frac{16}{144} + \frac{9}{144} = \frac{205}{144}$

£                £   s.
$\frac{205}{144}$   :   1   ::   287   :   201   12

£                £   s.
$\frac{205}{144}$   :   $\frac{1}{4}$   ::   287   :   50   8

£                £   s.
$\frac{205}{144}$   :   $\frac{1}{9}$   ::   287   :   22   8

£                £   s.
$\frac{205}{144}$   :   $\frac{1}{16}$   ::   287   :   12   12

(2)...        He gains £1¾ on every £100 borrowed

$$\begin{array}{ccccc} £ & & £ & £ & £ \\ 1\tfrac{3}{4} & : & 350 & :: \ 100 \ : & 20000 \end{array}$$

(3)...

$$
\begin{array}{l}
\quad\quad\quad\quad\quad\quad £ \quad s. \quad d. \\
2\tfrac{1}{2} \text{ per cent.} = \tfrac{1}{40} \,|\, 50 \quad 0 \quad 0 \\
\quad\tfrac{1}{2} \quad\quad,, \quad\quad = \tfrac{1}{8} \,|\, 1 \quad 5 \quad 0 \\
\quad\quad\quad\quad\quad\quad\quad\quad 5 \quad 0 \\
\hline
2\tfrac{1}{2} \text{ per cent.} = \tfrac{1}{40} \,|\, 51 \quad 10 \quad 0 \text{ amount at end of 1st year} \\
\quad\tfrac{1}{2} \quad\quad,, \quad\quad = \tfrac{1}{8} \,|\, 1 \quad 5 \quad 9 \\
\quad\quad\quad\quad\quad\quad\quad\quad 5 \quad 1\tfrac{4}{5} \\
\hline
2\tfrac{1}{2} \text{ per cent.} = \tfrac{1}{40} \,|\, 53 \quad 0 \quad 10\tfrac{4}{5} \text{ amount at end of 2nd year} \\
\quad\tfrac{1}{2} \quad\quad,, \quad\quad = \tfrac{1}{8} \,|\, 1 \quad 6 \quad 6\tfrac{27}{100} \\
\quad\quad\quad\quad\quad\quad\quad\quad 5 \quad 3\tfrac{327}{500} \\
\hline
\quad\quad\quad\quad\quad\quad £54 \quad 12 \quad 8\tfrac{181}{500} \text{ amount in 3 years}
\end{array}
$$

(4)...   One pipe admits $\tfrac{2}{25}$ of contents of bath in 1 minute,
the other   ,,   $\tfrac{1}{15}$   ,,   ,,   ,,
The discharging pipe lets out $\tfrac{1}{10}$ of contents in 1 minute

If all are open together the quantity remaining in the bath at
the end of 1 minute

$$= \frac{2}{25} + \frac{1}{15} - \frac{1}{10} = \frac{12+10-15}{150} = \frac{7}{150} \text{ of contents}$$

$$\tfrac{7}{150} \ : \ 1 \ :: \ 1 \text{ min.} \ : \ 21\tfrac{3}{7} \text{ minutes}$$

(5)...           Reduce the prices to pence

44d.

| 36d. | 39d. | 46d. | 51d. |
|------|------|------|------|
| 7 lb. | 2 lb. | 5 lb. | 8 lb. |

or 2 lb.   7 lb.   8 lb.   5 lb.

*Ans.* 7 lb. at 3s.; 2 lb. at 3s. 3d.; 5 lb. at 3s. 10d.; and 8 lb.
at 4s. 3d.

or, 2 lb. at 3s.; 7 lb. at 3s. 3d.; 8 lb. at 3s. 10d.; and 5 lb. at
4s. 3d.

Or any multiples of these quantities.

B B 2

*Proof.*

|  | s. | d. | s. | d. |  |  | s. | d. | s. | d. |
|---|---|---|---|---|---|---|---|---|---|---|
| 7 lb. at 3 | 0 | = | 21 | 0 |  | 2 lb. at 3 | 0 | = | 6 | 0 |
| 2 lb. „ 3 | 3 | = | 6 | 6 |  | 7 lb. „ 3 | 3 | = | 22 | 9 |
| 5 lb. „ 3 | 10 | = | 19 | 2 |  | 8 lb. „ 3 | 10 | = | 30 | 8 |
| 8 lb. „ 4 | 3 | = | 34 | 0 |  | 5 lb. „ 4 | 3 | = | 21 | 3 |
| 22 lb. |  |  | 80 | 8 |  | 22 lb. |  |  | 80 | 8 |

$$\overset{s.\quad d.\quad s.\quad d.}{22 \text{ lb. at } 3 \quad 8 \;=\; 80 \quad 8}$$

(6)...  The number of square yards dug by each man forms
an Arithmetical Progression.

$$\text{No. of sq. yds. dug by A} = \{2a + (n-1)d\}\frac{n}{2}$$

$$= \{900 - (5 \times 12)\}\,3$$

$$= 840 \times 3$$

$$= 2520$$

$$\text{No. of sq. yds. dug by B} = \{2a + (n-1)d\}\frac{n}{2}$$

$$= \{900 + (5 \times 15)\}\,3$$

$$= 975 \times 3$$

$$= 2925$$

A has dug 2520 sq. yds. for 11s., being at the rate of $229\frac{1}{11}$
sq. yds. for 1 shilling

B has dug 2925 sq. yds. for 13s., being at the rate of 225
sq. yds. for 1 shilling

∴ the engagement with A has proved more profitable than
that with B.

$$
(7)\ldots \quad
\begin{array}{c}\text{gent. da.} \\ 5 \times 25\end{array}
\;:\;
\begin{array}{c}\text{gent. da.} \\ 11 \times x \times \frac{4}{5}\end{array}
\;::\;
\begin{array}{c}\pounds \; s. \\ 93\;\;15 \\ 20 \\ \hline 1875\end{array}
\;:\;
\begin{array}{c}\pounds \; s. \\ 112\;\;4 \\ 20 \\ \hline 2244\end{array}
$$

$$
x = \frac{5 \times 25 \times 2244}{11 \times \frac{4}{5} \times 1875} = 17 \text{ days}
$$

(8)...  The weekly payments are in Arithmetical Progression
1st payment = 20 hf.-cr.; weekly increase = 3 hf.-cr.

$$
\text{Amount of debt} = \{2a + (n-1)d\}\frac{n}{2}
$$

$$
= \{40 + (24 \times 3)\} \tfrac{25}{2}
$$
$$
= 112 \times 12\tfrac{1}{2}
$$
$$
= 1400 \text{ half-crowns}
$$
$$
= \pounds 175
$$

$$
\text{last payment} = a + (n-1)d
$$
$$
= 20 + (24 \times 3)
$$
$$
= 92 \text{ half-crowns}
$$
$$
= \pounds 11 \; 10s.
$$

(9)...      $36\text{th term} = 3\tfrac{1}{2} + (36-1)1\tfrac{1}{5} = 3\tfrac{1}{2} + 42 = 45\tfrac{1}{2}$

$29\text{th term} = 7\tfrac{3}{4} + (29-1)1\tfrac{3}{8} = 7\tfrac{3}{4} + 38\tfrac{1}{2} = 46\tfrac{1}{4}$

(10)...        1.     $\text{Sum} = \{2a + (n-1)d\}\dfrac{n}{2}$

$$
= \{13\tfrac{1}{2} + (12 \times 3\tfrac{3}{16})\} \tfrac{13}{2}
$$
$$
= (13\tfrac{1}{2} + 38\tfrac{1}{4}) \tfrac{13}{2}
$$
$$
= 51\tfrac{3}{4} \times 6\tfrac{1}{2}
$$
$$
= 336\tfrac{3}{8}
$$

2.

$$\text{Sum} = \{2a + (n-1)d\}\frac{n}{2}$$

$$= \{34\tfrac{2}{5} - (8 \times 1\tfrac{4}{5})\}\tfrac{9}{2}.$$

$$= (34\tfrac{2}{5} - 14\tfrac{2}{5})\tfrac{9}{2}$$

$$= 20\tfrac{1}{5} \times 4\tfrac{1}{2}$$

$$= 90\tfrac{9}{10}$$

3.

$$\text{Sum} = \{2a + (n-1)d\}\frac{n}{2}$$

$$= \{11\tfrac{1}{3} - (15 \times \tfrac{5}{6})\}8$$

$$= (11\tfrac{1}{3} - 12\tfrac{1}{2})8$$

$$= (-1\tfrac{1}{6})8$$

$$= -9\tfrac{1}{3}$$

4.

$$\text{Sum} = \frac{a(r^n - 1)}{r - 1}$$

$$= \frac{3\tfrac{1}{2}\{(\tfrac{3}{2})^6 - 1\}}{1\tfrac{1}{2} - 1}$$

$$= \frac{3\tfrac{1}{2}(\tfrac{729}{64} - 1)}{\tfrac{1}{2}}$$

$$= 7 \cdot \tfrac{665}{64}$$

$$= 72\tfrac{47}{64}$$

5.     See *Exercise CXLVII.* (9) 3

$$\text{Sum} = \frac{a(1 - r^n)}{1 - r}$$

$$= \frac{13\{1 - (\tfrac{1}{2})^8\}}{1 - \tfrac{1}{2}}$$

$$= \frac{13(1 - \tfrac{1}{256})}{\tfrac{1}{2}}$$

$$= 26 \cdot \tfrac{255}{256}$$

$$= 25\tfrac{115}{128}$$

6.
$$\text{Sum} = \frac{a}{1-r}$$
$$= \frac{8}{1-\frac{3}{4}}$$
$$= \frac{8}{\frac{1}{4}}$$
$$= 32$$

## EXERCISE CL.

(1)...     A+B+C can do $\frac{2}{21}$ in 1 day

A+B     „     $\frac{2}{29}$     „

B+C     „     $\frac{2}{33}$     „

A can do $\dfrac{2}{21} - \dfrac{2}{33} = \dfrac{22-14}{231} = \dfrac{8}{231}$ in 1 day

C can do $\dfrac{2}{21} - \dfrac{2}{29} = \dfrac{58-42}{609} = \dfrac{16}{609}$ in 1 day

∴ A+C can do $\dfrac{8}{231} + \dfrac{16}{609} = \dfrac{232+176}{6699} = \dfrac{136}{2233}$ in 1 day

$$\frac{136}{2233} \; : \; 1 \; :: \; \overset{\text{day}}{1} \; : \; 16\tfrac{57}{136} \text{ days}$$

(2)...

Quantity of bricks made in 40 weeks $= 7500 \times 40 = 300000$

300000 bricks at 32s. 6d. per thousand $= £487$ 10s.

|  | £ | s. | d. |
|---|---|---|---|
| Rent of field (£5 × 11) .................. | 55 | 0 | 0 |
| Royalty upon bricks (2s. × 300) ...... | 30 | 0 | 0 |
| 35 tons of coals at 11s. 6d. per ton... | 20 | 2 | 6 |
| Wages of men (13s. 6d. × 6 × 40) ... | 162 | 0 | 0 |
| Wages of boys (5s. 6d. × 6 × 40) ...... | 66 | 0 | 0 |
|  | £333 | 2 | 6 |

|  | £ | s. | d. |
|---|---|---|---|
| Receipts | 487 | 10 | 0 |
| Expenses | 333 | 2 | 6 |
| Profit | £154 | 7 | 6 |

(3)...

lb. oz.
4 2
3 8

$$\overline{10} \quad : \quad 4 \quad 2 = 66 \quad :: \quad 1 \quad : \quad 6\tfrac{3}{5}$$

lb. oz.
6 4
5 6

$$\overline{14} \quad : \quad 6 \quad 4 = 100 \quad :: \quad 1 \quad : \quad 7\tfrac{1}{7}$$

$$6\tfrac{3}{5} \quad : \quad 7\tfrac{1}{7}$$

$$\tfrac{33}{5} \quad : \quad \tfrac{50}{7}$$

$$231 \quad : \quad 250$$

(4)...

A 9 horses for 12 weeks $= 9 \times 1 \times 12 = 108$
B 12 cows for 16 weeks $= 12 \times \tfrac{3}{5} \times 16 = 115\tfrac{1}{5}$
C 45 sheep for 26 weeks $= 45 \times \tfrac{9}{100} \times 26 = 105\tfrac{3}{10}$
$$\overline{328\tfrac{1}{2}}$$

$$328\tfrac{1}{2} \quad : \quad 108 \quad :: \quad 18 \overset{£}{\phantom{1}} \; 5\overset{s.}{\phantom{1}} \quad : \quad 6 \overset{£}{\phantom{1}} \quad \text{A}$$

$$328\tfrac{1}{2} \quad : \quad 115\tfrac{1}{5} \quad :: \quad 18 \overset{£}{\phantom{1}} \; 5\overset{s.}{\phantom{1}} \quad : \quad 6 \overset{£}{\phantom{1}} \; 8\overset{s.}{\phantom{1}} \quad \text{B}$$

$$328\tfrac{1}{2} \quad : \quad 105\tfrac{3}{10} \quad :: \quad 18 \overset{£}{\phantom{1}} \; 5\overset{s.}{\phantom{1}} \quad : \quad 5 \overset{£}{\phantom{1}} \; 17\overset{s.}{\phantom{1}} \quad \text{C}$$

(5)...

$$3 \times \cdot 95 = 2 \cdot 85$$
$$7 \times 1 \cdot 15 = 8 \cdot 05$$
$$\underline{12} \times 1 \cdot 36 = \underline{16 \cdot 32}$$
$$\overline{22} \qquad\qquad \overline{27 \cdot 22}$$

$$27 \cdot 22 \div 22 = 1 \cdot 23\dot{7}\dot{2}$$

(6)...

| | £ | s. | d. |
|---|---|---|---|
| 55 acres at 44s. per acre ...... = | 121 | 0 | 0 |
| Expended for labour, &c. ...... = | 125 | 0 | 0 |
| Tithes and rates (13s. 6d. × 55) = | 37 | 2 | 6 |
| | £283 | 2 | 6 |

$$
\begin{array}{r}
& \pounds \quad s. \quad d. \\
28 \times 55 = 1540 \text{ bushels of wheat at } 5s.\ 9d. = 442 \quad 15 \quad 0 \\
283 \quad 2 \quad 6 \\
\hline
\text{Profit on the holding at } 44s. \text{ per acre} = \pounds159 \quad 12 \quad 6
\end{array}
$$

$$
\begin{array}{lr}
& \pounds \quad s. \quad d. \\
35 \text{ acres at } 37s.\ 6d. \text{ per acre } \dots = & 65 \quad 12 \quad 6 \\
\text{Expended for labour, \&c}\dots\dots\dots = & 63 \quad 0 \quad 0 \\
\text{Tithes and rates } (13s.\ 6d. \times 35) = & 23 \quad 12 \quad 6 \\
\hline
& \pounds152 \quad 5 \quad 0
\end{array}
$$

$$
\begin{array}{r}
& \pounds \quad s. \quad d. \\
1600 \text{ bushels of oats at } 2s.\ 10d. = 226 \quad 13 \quad 4 \\
152 \quad 5 \quad 0 \\
\hline
\text{Profit on holding at } 37s.\ 6d. \text{ per acre} = \pounds74 \quad 8 \quad 4
\end{array}
$$

$\pounds\ s.\ d.$     $\pounds\ s.\ d.$

$283\ 2\ 6$   :   $159\ 12\ 6$   ::   $100$   :   $56\frac{172}{453}$ per cent.

$\pounds\ s.$     $\pounds\ s.\ d.$

$152\ 5$   :   $74\ 8\ 4$   ::   $100$   :   $48\frac{604}{1827}$ per cent.

The land rented at 44s. per acre is therefore the more profitable occupation.

(7)...    1.   The minute-hand has to gain 3 rounds

ro.     ro.     hrs.

$11$   :   $3$   ::   $12$   :   3 hrs. 16 min. $21\frac{9}{11}$ sec.

       2.   The minute-hand has to gain $3\frac{1}{4}$ rounds

ro.     ro.     hrs.

$11$   :   $3\frac{1}{4}$   ::   $12$   :   3 hrs. 32 min. $43\frac{7}{11}$ sec.

       3.   The minute-hand has to gain $3\frac{1}{3}$ rounds

ro.     ro.     hrs.

$11$   :   $3\frac{1}{3}$   ::   $12$   :   3 hrs. 38 min. $10\frac{10}{11}$ sec.

       4.   The minute-hand has to gain $3\frac{1}{2}$ rounds

ro.     ro.     hrs.

$11$   :   $3\frac{1}{2}$   ::   $12$   :   3 hrs. 49 min. $5\frac{5}{11}$ sec.

(8)...   2 ac. 1 ro. 19 per. $11\frac{1}{4}$ sq. yds. = 11476 sq. yds.

A   350+  358+  366+  374+ &c. to $n$ terms
B   380+  374+  368+  362+ &c.       „
C   320+  330+  340+  350+ &c.       „
D   360+  355+  350+  345+ &c.       „
$s =$ $\overline{1410+1417+1424+1431+ \text{&c. to } n \text{ terms}}$

$$s = \{2a+(n-1)d\}\frac{n}{2}$$

$$11476 = \{2820+(n-1)7\}\frac{n}{2}$$

or, $7n^2+2813n = 22952$

from which equation, $n = 8$, the number of days


(9)...No. of yards = $200+160+128+102\frac{2}{5}+$ &c. in infinitum

the formula for which series is $\dfrac{a}{1-r}$

here $\dfrac{a}{1-r} = \dfrac{200}{1-\frac{4}{5}} = \dfrac{200}{\frac{1}{5}} = 1000$ yards


(10)...$4\frac{1}{2}$ per cent. on £2000000 = £ 90000 per annum
      5 per cent. on £4000000 =   200000      „
      60 per cent. on receipts = £290000      „

      60  :  100  ::  £290000  :  £483333  $s.$ 6  $d.$ 8

Required weekly receipts = £483333  $s.$ 6  $d.$ 8 ÷ 52

                    = £9294  17$s.$  $5\frac{3}{13}d.$

# EXERCISES IN MENSURATION.

## *EXERCISE I.*

(1)...

| sq. yds. | sq. ft. |
|---|---|
| 15 | 7 |

$$\begin{array}{r} 9 \\ \hline 142 \\ 144 \\ \hline 568 \\ 568 \\ 142 \\ \hline 20448 \text{ sq. inches} \end{array}$$

(2)...

$$144 \left\{ \begin{array}{l} 12)\overline{16848} \\ 12)\ \overline{1404} \end{array} \right.$$

sq. in.

$$9)\ \overline{117}$$

$$\overline{13} \text{ sq. yds.}$$

(3)...

$$\begin{array}{r} 43^\circ\ 19'\ 47'' \\ 60 \\ \hline 2599 \\ 60 \\ \hline 155987 \text{ seconds} \end{array}$$

(4)...

$$24'\ 35'' = 1475 \text{ seconds}$$
$$1^\circ = 3600 \quad ,,$$
$$\tfrac{1475}{3600} \div \tfrac{25}{25} = \tfrac{59}{144} \text{ of a degree}$$

(5)...

$$\begin{array}{r} 4)\ 3 \\ 60)\overline{18\cdot75} \\ 60)\overline{25\cdot3125} \\ \hline \cdot421875 \text{ of a degree} \end{array}$$

(6)...

$$\begin{array}{r} 90^\circ\ \ 0'\ \ 0'' \\ 37^\circ\ 25'\ 45'' \\ \hline 52^\circ\ 34'\ 15'' \end{array}$$

(7)... The $3 \angle s = 180^\circ\ \ 0'$
$$55^\circ\ 45' \times 2 = 111^\circ\ 30'$$
$$\text{Vertical } \angle = \overline{\ 68^\circ\ 30'}$$

(8)...

| ft. | | ft. | | ft. | |
|---|---|---|---|---|---|
| $6\frac{3}{4}$ | : | 8 | :: | 189 | : $x$ |

$$x = \frac{4}{27} \times \frac{8}{1} \times \frac{189}{1} = 224 \text{ feet}$$

(9)...

| ft. | in. |  |
|---|---|---|
| 9 | 7 |  |
| 4 | 9 |  |
| 38 | 4 |  |
| 7 | 2 | 3 |
| 45 | 6 | 3 |

= 45 sq. ft. 75 sq. in.

| ft. | in. |  |
|---|---|---|
| 13 | 8 |  |
| 11 | 4 |  |
| 150 | 4 |  |
| 4 | 6 | 8 |
| 154 | 10 | 8 |

= 154 sq. ft. 128 sq. in.

(10)...

| 13 ft. | 7′ | 10″ |  |  |
|---|---|---|---|---|
| 9 ft. | 8′ | 3″ |  |  |
| 122 | 10 | 6 |  |  |
| 9 | 1 | 2 | 8 |  |
| 3 | 4 | 11 | 6 |  |
| 132 ft. | 3′ | 1″ | 7‴ | 6⁗ |

## EXERCISE II.

(1)...
| ft. | in. |  |
|---|---|---|
| 10 | 9 |  |
| 4 | 2 |  |
| 43 | 0 |  |
| 1 | 9 | 6 |
| 44 | 9 | 6 |

= 44 sq. ft. 114 sq. in.

(2)...
```
     ft.
     29
     29
    ───
    261
     58
    ─── sq. ft.
    841
    144
   ─────
   3364
   3364
    841
  ──────
  121104 sq. in.
```

(3)...
```
      sq. in.
 144)45
   9) 7·3125
      ──────
      ·8125 of a sq. yd.
```

```
4840)3267·000(·675 of an acre
     29040
     ─────
     36300
     33880
     ─────
     24200
     24200
     ─────
```

(4)...
```
    yds.   ft.
    35 =  105
           25
          ───
          525
          210
       9)2625 sq. ft.
         ───────
          291 sq. yds. 6 sq. ft.
```

(5)...
  ft.
  24
  24
  $\overline{96}$
  48
18 $\left\{\begin{array}{l} 3)\overline{576} \text{ sq. ft.} \\ 6)\overline{192} \end{array}\right.$
  $\overline{32 \text{ feet}}$

(6)...   1 acre = 4840 sq. yds.
      $4\frac{1}{2}$
     $\overline{19360}$
     2420
36 $\left\{\begin{array}{l} 6)\overline{21780} \\ 6)\ \overline{3630} \end{array}\right.$
     $\overline{605 \text{ trees}}$

(7)...  $\overset{\text{sq. ft.}}{12\frac{1}{4}} \div \overset{\text{in.}}{10\frac{1}{2}} = \overset{\text{sq. ft.}}{12\frac{1}{4}} \div \overset{\text{ft.}}{\frac{7}{8}} = \frac{\overset{7}{\cancel{49}}}{\cancel{4}} \times \frac{\overset{2}{\cancel{8}}}{7} = 14 \text{ feet}$

(8)...  Area of yard = $\overset{\text{ft.}}{87} \times \overset{\text{ft.}}{45} = \overset{\text{sq. ft.}}{3915} = \overset{\text{sq. in.}}{563760}$

   Area of each tile = $9 \times 9 = 81$ sq. in.

   No. of tiles = $563760 \div 81 = 6960$

(9)...  11 acres 16 perches = 1776 perches

   Area of each allotment = $1776 \div 32 = 55\frac{1}{2}$ per.

         = 1 rood $15\frac{1}{2}$ per.

(10)...  Area of chess-board = $\overset{\text{in.}}{15} \times \overset{\text{in.}}{15} = 225$ sq. in.

   No. of divisions = 64

   $225 \div 64 = 3\frac{33}{64}$ sq. inches, area of each division

*EXERCISE III.*

(1)...
$$\begin{array}{rrr}90° & 0' & 0'' \\ 27° & 25' & 38'' \\ \hline 62° & 34' & 22'' \end{array}$$

(2)...
$$\begin{array}{rr}90° & 0' \\ 21° & 26' \\ \hline 2)68° & 34' \\ \hline 34° & 17' \text{ smaller angle} \\ 21° & 26' \\ \hline 55° & 43' \text{ larger angle} \end{array}$$

(3)...
$$\begin{array}{cc} \text{ft.} & \text{in.} \\ 3 & 2 \\ 2 & 2 \\ \hline 6 & 4 \\ & 6 \quad 4 \\ \hline 6 \quad 10 & 4 = 6 \text{ sq. ft. 10 primes, 4 sq. in.} = 6 \text{ sq. ft. 124 sq. in.} \end{array}$$
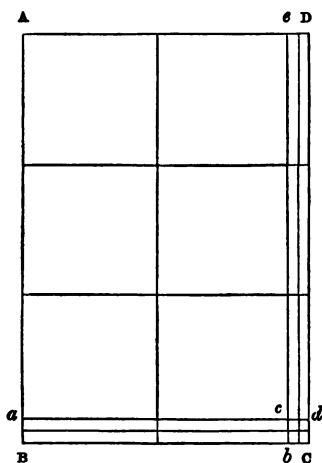


1 sq. ft. = 1 ft. × 1 ft.

1 prime = 1 ft. × 1 in. = $\frac{1}{12}$ sq. ft. = 12 sq. in.

1 sq. in. = 1 in. × 1 in.

$$A ace = 6 \text{ sq. feet}$$
$$aBbc + cdDe = 10 \text{ primes}$$
$$cbCd = 4 \text{ sq. inches}$$
$$ABCD = 6 \text{ sq. ft. 10 primes, 4 sq. in.}$$

(4)...
$$
\begin{array}{cc}
\text{ft.} & \text{in.} \\
4 & 4 \\
4 & 4 \\
\hline
17 & 4 \\
1 & 5 \quad 4 \\
\hline
18 & 9 \quad 4 = 18 \text{ sq. ft. } 112 \text{ sq. in.}
\end{array}
$$

(5)...          1 sq. foot = 144 sq. inches

$$144 \div 10\tfrac{1}{2} = \frac{\overset{48}{\cancel{144}}}{1} \times \frac{2}{\underset{7}{\cancel{21}}} = \frac{96}{7} = 13\tfrac{5}{7} \text{ inches}$$

(6)...
$$
\begin{array}{cc}
\text{ft.} & \text{in.} \\
22 & 8 \\
14 & 4 \\
\hline
317 & 4 \\
7 & 6 \quad 8 \\
\hline
324 & 10 \quad 8 = 324 \text{ sq. ft. } 128 \text{ sq. in.}
\end{array}
$$

(7)...
$$
\begin{array}{r}
\text{links} \\
1345 \\
880 \\
\hline
107600 \\
107600 \\
\hline
11\cdot83600 \text{ ac.} \\
4 \\
\hline
3\cdot34400 \text{ ro.} \\
40 \\
\hline
13\cdot76000 \text{ po.}
\end{array}
$$

11 acres, 3 roods, $13\tfrac{19}{25}$ poles

(8)...

Area of 1 sheet = $45 \times 29\tfrac{1}{2} = 1327\tfrac{1}{2}$

$$
144 \begin{cases}
12\overline{)31860} \\
12\overline{)\ 2655}
\end{cases}
$$
$$
9\overline{)\ 221} \quad 3 = 36 \text{ sq. in.}
$$

24 sq. yds. 5 sq. ft. 36 sq. in.

(9)... Area of lawn $= 42$ yds. $\times 32$ yds. $= 1344$ sq. yds.

$= 1741824$ sq. in.

Area of each sod $= 2$ ft. $\times 16$ in. $= 384$ sq. in.

No. of sods $= 1741824 \div 384 = 4536$

(10)...    40 sq. ft. 12 sq. in. $= 5772$ sq. inches

12 ft. 4 in. $= 148$ inches

5772 sq. in. $\div 148$ in. $= 39$ in. $= 3$ ft. 3 in.

### EXERCISE IV.

<div>

(1)...
| ft. | in. |
|-----|-----|
| 10  | 6   |
| 4   | 2   |
| 42  | 0   |
| 1   | 9   |
| 43  | 9 $= 43\frac{3}{4}$ sq. ft. |

(2)... The 3 angles contain $180°$

$2+3+4 = 9$

$9 : 2 :: 180° : 40°$

$9 : 3 :: 180° : 60°$

$9 : 4 :: 180° : 80°$

</div>

(3)...

in.

13 ft. 8 in. $=164$

1 ft. 4 in. $= 16$

$\overline{984}$

$164$

$\overline{2624}$ sq. in.

(4)...

yds.

$185$

$121$

$\overline{22385}$ sq. yds.

$4$

$\begin{array}{l} 11)\overline{89540} \\ 11)\ \overline{8140} \end{array}$     yds.    qrs.
$30\frac{1}{2} = 121$

$40)\ \overline{740}$

$4)\ \overline{18\ \ 20}$

$\overline{4\text{ac. 2 ro. 20 per.}}$

(5)...    Area of square $= 12$ yds. $\times 12$ yds. $= 144$ sq. yds.

Area of par$^m$ $= 42$ ft. $\times 30$ ft. $= 1260$ sq. ft. $= 140$ sq. yds.

Difference $= \overline{\ \ 4}$ sq. yds

(6)...        Area of each side = $4\frac{1}{2} \times 4\frac{1}{2}$ = $20\frac{1}{4}$
                                                                    6
            Surface of cube = $\overline{121\frac{1}{2}}$ sq. in.


(7)... Area of each plank = 15 ft. × 10 in. = $12\frac{1}{2}$ sq. ft.

    Area of floor = 30 ft. × $22\frac{1}{2}$ ft. = 675 sq. ft.

    No. of planks = $675 \div 12\frac{1}{2}$ = 54


(8)... 2 ro. 20 per. = 100 per.        (9)... $4\frac{3}{4}$ ac. = $\overset{\text{sq. yds.}}{22990}$

    $\sqrt{100}$ = 10 per. = 55 yds.        $\overset{\text{sq. yds.}}{22990} \div \overset{\text{yds.}}{187}$ = $\overset{\text{yds.}}{122\frac{16}{17}}$

(10)...  Area of court = $\overset{\text{yds.}}{42} \times \overset{\text{yds.}}{42}$ = $\overset{\text{sq. yds.}}{1764}$ = $\overset{\text{sq. in.}}{2286144}$

Dimensions of each tile = $2286144 \div 28224$ = 81 sq. in.
                                                    = 9 inches square


## EXERCISE V.

(1)...            180°   0'   0''        (2)...    $\overset{\text{links}}{875}$
                   42°  35'   0''                    750
                2)$\overline{137°\ 25'\ \ 0''}$      $\overline{43750}$
Each ∠ at base = $\overline{68°\ 42'\ 30''}$         6125
                                                    $\overline{6\cdot56250}$ ac.
                                                       4
(3)... 2 sq. ft. = 288 sq. in.                      $\overline{2\cdot25000}$ ro.
                                                      40
$288 \div 6\frac{3}{4} = 42\frac{2}{3}$ in. = 3 ft. $6\frac{2}{3}$ in.   $\overline{10\cdot00000}$ per.

                                        6 ac. 2 ro. 10 per.
                    c c

|  | ft. | ′ | ″ |  |  | ft. | ′ | ″ |
|---|---|---|---|---|---|---|---|---|
| (4)... | 7 | 8 | 6 |  |  | 9 | 7 | 6 |
|  | 7 | 8 | 6 |  |  | 5 | 4 | 6 |
|  | 53 | 11 | 6 |  |  | 48 | 1 | 6 |
|  | 5 | 1 | 8 | 0 |  | 3 | 2 | 6 |
|  |  | 3 | 10 | 3 |  |  | 4 | 9 | 9 |
|  | 59ft. | 5′ | 0″ | 3‴ |  | 51ft. | 8′ | 9″ | 9‴ |

$$
\begin{array}{cc}
& \text{sq. ft.} \qquad \text{sq. ft.} \\
(6)\dots & 272\tfrac{1}{4} = 272{\cdot}25(16{\cdot}5 = 16\tfrac{1}{2}\ \text{ft.}
\end{array}
$$

|  | ft. | in. |
|---|---|---|
| (5)... | 9 | 8 |
|  | 5 | 3 |
|  | 48 | 4 |
|  | 2 | 5 |
| 2)50 | 9 |  |
|  | 25 | 4½ | = 25 sq. ft. 54 sq. in. |

$$
\begin{array}{r}
1 \\
26)\overline{172} \\
156 \\
325)\ \overline{1625} \\
1625
\end{array}
$$

(7)...Area of each slate = 13 in. × 8½ in. = 110½ sq. in.

Area of roof = 42¼ ft. × 25½ ft. = 155142 sq. in.

No. of slates = 155142÷110½ = 1404

|  | ft. | in. |  |  |  | ft. | in. |  |  |
|---|---|---|---|---|---|---|---|---|---|
| (8)... | 18 | 8 |  |  |  | 16 | 10 |  |  |
|  | 18 | 8 |  |  |  | 16 | 10 |  |  |
|  | 336 | 0 |  |  |  | 269 | 4 |  |  |
|  | 12 | 5 | 4 |  |  | 14 | 0 | 4 |  |
|  | 348 | 5 | 4 |  |  | 283 | 4 | 4 |  |

| sq. ft. | ′ | ″ | sq. ft. | sq. in. |
|---|---|---|---|---|
| 348 | 5 | 4 = | 348 | 64 |
| 283 | 4 | 4 = | 283 | 52 |
| Difference = |  |  | 65 | 12 |

(9)...

$$
\begin{array}{r}
\text{yds.} \\
4)\overline{170} \\
\text{Side of garden} = \overline{42\cdot5} \text{ yards} \\
42\cdot5 \\
\hline
2125 \\
850 \\
1700 \\
\hline
\text{Area of garden} = \overline{1806\cdot25} = 1806\tfrac{1}{4} \text{ sq. yds.}
\end{array}
$$

(10)... Area of room $= 27$ ft. $\times 21\tfrac{1}{4}$ ft. $= 573\tfrac{3}{4}$ sq. ft.

Area of 1 yd. carpeting $= 3$ ft. $\times 3$ ft. $= 9$ sq. ft.

No. of yds. required $= 573\tfrac{3}{4} \div 9 = 63\tfrac{3}{4}$

## EXERCISE VI.

(1)...

$$
\begin{array}{rccc}
& \text{ft.} & ' & '' \\
8\cdot375 \text{ yards} = & 25 & 1 & 6 \\
9\tfrac{5}{6} \text{ feet} = & 9 & 10 & 0 \\
\hline
& 226 & 1 & 6 \\
& 20 & 11 & 3 \\
\hline
& 247 & 0 & 9 = 247 \text{ sq. ft. } 9 \text{ sq. in.}
\end{array}
$$

(2)... 225 links $= 2\tfrac{1}{4}$ chains $= 49\tfrac{1}{2}$ yards

$$
\begin{array}{r}
49\tfrac{1}{2} = 49\cdot5 \\
49\cdot5 \\
\hline
2475 \\
4455 \\
1980 \\
\hline
2450\cdot25 = 2450\tfrac{1}{4} \text{ sq. yds.}
\end{array}
$$

(3)... Area of floor $= 31\tfrac{1}{2}$ ft. $\times 25\tfrac{1}{2}$ ft. $= 803\tfrac{1}{4}$ sq. ft.

Area of 1 yd. drugget $= 4\tfrac{1}{2}$ ft. $\times 3$ ft. $= 13\tfrac{1}{2}$ sq. ft.

Length of drugget required $= 803\tfrac{1}{4} \div 13\tfrac{1}{2} = 59\tfrac{1}{2}$ yds.

(4)... See Appendix, page 178.

Area of square $= \dfrac{35 \times 35}{2} = 612\tfrac{1}{2}$ square yards

(5)... Area of rectangle = 18 ft. × 12 ft. = 216 sq. ft.

Side of square = $\sqrt{216}$ = 14·69 ft.

(6)...

$$
\begin{array}{rr}
\text{ft.} & \text{in.} \\
7 & 6 \\
4 & 3 \\
\hline
30 & 0 \\
1\ 10 & 6 \\
\end{array}
$$

Area of door = $\overline{31\ 10\ \ 6}$ = $31\frac{7}{8}$ sq. ft.

$$
\begin{array}{cccccc}
\text{sq. ft.} & & \text{sq. ft.} & & d. & \\
9 & : & 31\frac{7}{8} & :: & 15 & : & x
\end{array}
$$

$$x = \frac{1}{\cancel{9}} \times \frac{\cancel{255}^{85}}{8} \times \frac{\cancel{15}^{5}}{1} = \frac{425}{8}d. = 4s.\ 5\frac{1}{8}d.$$

(7)... 3 acres 1 rood 4 poles 25 yards = 15876 sq. yds.

Side of field = $\sqrt{15876}$ = 126 yds.

(8)..

$$
\begin{array}{rr}
& \text{yds.} \\
\tfrac{3}{4}\ \text{mile} = & 1320 \\
48\ \text{feet} = & 16 \\
\hline
\text{Area of street} = & \overline{21120}\ \text{sq. yds.}
\end{array}
$$

$$
\begin{array}{ll}
1s.\ 8d. = \tfrac{1}{12}\ \text{of £1} & \left|\begin{array}{r} 21120 \\ \hline 1760 \\ 88 \\ \hline £1848 \end{array}\right. \\
1d. = \tfrac{1}{20}\ \text{of } 1s.\ 8d. &
\end{array}
$$

(9)...

$$
\begin{array}{rr}
7^2 = & 49 \\
9^2 = & 81 \\
11^2 = & 121 \\
\end{array}
$$

Area of 3 given squares = $\overline{251}$ sq. yds.

Side of required square = $\sqrt{251}$ = 15·8429 yds.

(10)... Area of floor $= 27\frac{1}{2}$ ft. $\times 20\frac{1}{4}$ ft. $= 556\frac{7}{8}$ sq. ft.

Area of 1 yd. carpeting $= 2\frac{1}{4}$ ft. $\times 3$ ft. $= 6\frac{3}{4}$ sq. ft.

Carpeting required $= 556\frac{7}{8} \div 6\frac{3}{4} = 82\frac{1}{2}$ yds.

### EXERCISE VII.

(1)...                    $1+2+2 = 5$

3 angles of triangle $= 180°$

$$5 \overline{)180°}$$

Vertical angle $= \overline{36°}$

$$\frac{2}{}$$

Each angle at base $= \overline{72°}$

```
       ft.  in.                        ft.   '   " ·
(2)...18   6               (3)...  17   5   8
      12   8                         9   4   3
    ─────────                     ───────────────
     222   0                       157   3   0
      12   4                         5   9  10   8
   2)234   4                         4   4   5
    ─────────                     ───────────────────
     117   2 = 117 sq. ft. 24 sq. in.   163ft. 5'  3"  1'''
```

```
                          ft.  in.
(4)...                     5  10
                           2   6
                         ─────────
                          11   8
                           2  11
```

Area of slab $= \overline{14 \quad 7} = 14\frac{7}{12}$ sq. ft.

$14\frac{7}{12}$ sq. ft. at 3s. 6d. per foot $= £2$ 11s. $0\frac{1}{2}d$.

(5)...Area of yard $= 69$ ft. $\times 24$ ft. $= 1656$ sq. ft. $= 238464$ sq. in.

Area of each brick $= 9$ in. $\times 4\frac{1}{2} = 40\frac{1}{2}$ sq. in.

No. of bricks required $= 238464 \div 40\frac{1}{2} = 5888$

(6)...
$$\begin{array}{cc} \text{ft.} & \text{in.} \\ 10 & 9 \\ 1 & 4 \\ \hline 10 & 9 \\ 3 & 7 \end{array}$$

Area of plank = $\overline{14\quad 4}$ = $14\frac{1}{3}$ sq. ft.

$14\frac{1}{3}$ sq. ft. at 1s. 6d. per foot = £1 1s. 6d.

(7)...
$$(12\tfrac{1}{4})^3 \div (1\tfrac{3}{4})^3 = \frac{\overset{7}{\cancel{49}}}{\cancel{4}} \times \frac{\overset{7}{\cancel{49}}}{\cancel{4}} \times \frac{\overset{7}{\cancel{49}}}{\cancel{4}} \times \frac{\cancel{4}}{7} \times \frac{\cancel{4}}{7} \times \frac{\cancel{4}}{7}$$

$$= 343 \text{ cubes.}$$

(8)...
$$\begin{array}{cc} \text{ft.} & \text{in.} \\ 8 & 3 \\ 4 & 2 \\ \hline 33 & 0 \\ 1 & 4 \quad 6 \end{array}$$

Area of door = $\overline{34\quad 4\quad 6}$ = $34\frac{3}{8}$ sq. ft.

$34\frac{3}{8}$ sq. ft. at 1s. 6d. per foot = £2 11s. $6\frac{9}{16}d$.

(9)... Area of floor = $21\frac{1}{2}$ ft. $\times 16\frac{2}{3}$ ft. = $358\frac{1}{3}$ sq. ft.

Area of 1 yd. carpeting = 3 ft. $\times$ 3 ft. = 9 sq. ft.

Carpeting required = $358\frac{1}{3} \div 9 = 39\frac{22}{27}$ yds.

$39\frac{22}{27}$ yds. at 4s. 6d. per yd. = £8 19s. 2d.

(10)...
$$\begin{array}{ccccccccc} \text{sq. yds.} & & \text{yds.} & \text{yds.} & & s. & d. & & \\ 4840 & : & 192 & \times 168 & :: & 13 & 9 & : & x \\ & & & & & & 12 & & \\ & & & & & \hline & & 165 & & \end{array}$$

$$x = \frac{\overset{24}{\cancel{192}} \times 168 \times \overset{3}{\cancel{165}}}{\underset{\underset{11}{605}}{\cancel{4840}}} = \frac{12096}{11} = £4 \ 11s. \ 7\frac{7}{11}d.$$

## *EXERCISE VIII.*

(1)...A *trapezium* is a plane figure, having 4 unequal sides, no
two of which are parallel.

A *trapezoid* is a plane four-sided figure, having two of its
opposite sides parallel.

For rules for finding the areas, see Appendix, page 179.

(2)...

$$\begin{array}{r} \text{ft.} \quad \text{in.} \\ 49 \text{ yds.} = 147 \quad 0 \\ 9 \text{ ft. 6 in.} + 13 \text{ ft. 10 in.} = \underline{\phantom{0}23 \quad 4} \\ 3381 \quad 0 \\ \underline{49 \quad 0} \\ 2)\overline{3430 \quad 0} \\ 9)\overline{1715 \quad 0} \\ \overline{190 \text{ sq. yds. 5 sq. ft.}} \end{array}$$

(3)...

$$\begin{array}{r} \text{ft.} \quad \text{in.} \\ 19 \text{ ft.} + 23 \text{ ft.} = 42 \quad 0 \\ \underline{9 \quad 8} \\ 378 \quad 0 \\ \underline{28 \quad 0} \\ 2)\overline{406 \quad 0} \\ \overline{203 \text{ sq. ft.}} \end{array}$$

(4)...

$$\begin{array}{r} \text{ft.} \quad ' \quad '' \\ 96 \quad 10 \quad 0 \\ \underline{23 \quad 4 \quad 6} \\ 2227 \quad 2 \quad 0 \\ 32 \quad 3 \quad 4 \\ \underline{4 \quad 0 \quad 5} \\ 2)\overline{2263 \quad 5 \quad 9} \\ \overline{1131 \quad 8 \quad 10\tfrac{1}{2}} = 1131 \text{ sq. ft. } 106\tfrac{1}{2} \text{ sq. in.} \end{array}$$

(5)...    684 cu. in. = $\frac{684}{1728} + \frac{36}{34} = \frac{19}{48}$ of a cubic foot

12 cu. ft. 432 cu. in. = 21168 cu. in.

1 cu. yd. = 46656 cu. in.

$\frac{21168}{46656} + \frac{432}{432} = \frac{49}{108}$ of a cubic yard

(6)...

$$40)21$$
$$27)\overline{15\cdot525}$$

$15\frac{21}{40}$ cu. ft. = $\cdot575$ of a cubic yard

(7)...

$$18 \text{ ft.} = 216 \text{ in.}$$
$$15$$
$$\overline{3240}$$
$$10$$
$$1728)\overline{32400}(18 \text{ cu. ft. } 1296 \text{ cu. in.}$$
$$1728$$
$$\overline{15120}$$
$$13824$$
$$\overline{1296} \text{ cu. in.}$$

(8)...

$$4 \text{ ft. } 2 \text{ in.} = 50 \text{ in.}$$
$$50$$
$$\overline{2500}$$
$$2$$
$$\overline{5000}(70\cdot71 \text{ in.} = 5 \text{ ft. } 10\cdot71 \text{ in.}$$
$$49$$
$$1407)\ \overline{10000}$$
$$9849$$
$$14141)\ \overline{15100}$$
$$14141$$
$$\overline{959}$$

(9)...

| ft. | in. | |
|---|---|---|
| 2 | 7 | |
| 2 | 7 | |
| 5 | 2 | |
| 1 | 6 | 1 |
| 6 | 8 | 1 |
| 2 | 7 | |
| 13 | 4 | 2 |
| 3 | 10 | 8   7 |
| 17 | 2 | 10   7 = 17 cu. ft. 415 cu. in. |

|     | ft. | in. |     | ft. | in. |
|-----|-----|-----|-----|-----|-----|
| (10)... | 21 | 9 |     | 17 | 6 |
|     | 16 | 8 |     | 12 | 10 |
|     | 348 | 0 |     | 210 | 0 |
|     | 14 | 6 |     | 14 | 7 |
|     | 362 | 6 |     | 224 | 7 |

sq. ft.

Area of floor = 362   6

Area of carpet = 224   7

Portion of floor uncovered = 137 11 = 137 sq. ft. 132 sq. in

### EXERCISE IX.

(1)...
$$90°$$
$$54·375°$$
$$\overline{35·625°} = 35° 37' 30''$$
$$60$$
$$\overline{37·500'}$$
$$60$$
$$\overline{30·000''}$$

(2)...

yds.
112
180
2)20160
10080 sq. yds.
4

$$\begin{array}{l} \text{yds.} \quad \text{qrs.} \\ 30\tfrac{1}{4} = 121 \end{array} \left\{ \begin{array}{l} 11)40320 \\ 11)3665 \quad 5 \\ 40)333 \quad 2 \\ 4)8 \quad 13 \end{array} \right\} 27 \text{ qrs.} = 6\tfrac{3}{4} \text{ yds.}$$

2 ac. 13 po. 6¾ sq. yds.

```
        yds.                        ft.  in.
(3)...   116          (4)...6   9
         116                3   4
       ‾‾‾‾‾‾              ‾‾‾‾‾‾‾‾
        13456               20   3
            2                2   3
       ‾‾‾‾‾‾‾‾            ‾‾‾‾‾‾‾‾
        26912(164·0487 yds. 22   6
            1                2   3
      ‾‾‾‾‾‾‾              ‾‾‾‾‾‾‾‾
    26)169                   45   0
       156                    5   7  6
   ‾‾‾‾‾‾‾‾                ‾‾‾‾‾‾‾‾‾‾‾
  324) 1312                  50   7  6 = 50 cu. ft. 1080 cu. in.
      1269
 ‾‾‾‾‾‾‾‾‾‾‾
32804)  160000
        131216
  ‾‾‾‾‾‾‾‾‾‾‾‾
328088)  2878400
         2624704
  ‾‾‾‾‾‾‾‾‾‾‾‾‾
3280967)  25369600
          22966769
      ‾‾‾‾‾‾‾‾‾‾‾
           2402831
```

(5)...        34 sq. yds. 2 sq. ft. = 308 sq. ft.
                 18 ft. 8 in. = $18\frac{2}{3}$ ft.

$$\underset{\text{sq. ft.}}{308} \div \underset{\text{ft.}}{18\tfrac{2}{3}} = \frac{\overset{11}{\cancel{308}}}{1} \times \frac{3}{\underset{2}{\cancel{56}}} = \frac{33}{2} \text{ ft.} = 16 \text{ ft. } 6 \text{ in.}$$

(6)...        14 ft. × $10\frac{1}{2}$ in. × 28 = 343 sq. ft.
       343 sq. ft. at $6\frac{1}{2}d.$ per foot = £9 5s. $9\frac{1}{2}d.$

(7)...See Appendix, page 178.

```
        52              94 − 52 = 42
        64              94 − 64 = 30
        72              94 − 72 = 22
     ‾‾‾‾‾‾
    2)188
     ‾‾‾‾‾
      94
```

$$94 \times 42 \times 30 \times 22 = 2605680$$

Area of garden = $\sqrt{2605680}$ = 1614·2118 sq. yds.

(8)...

$$\begin{array}{ll} \text{ft.} & \text{in.} \\ 73 & 6 \\ 29 & 3 \\ \hline 2131 & 6 \\ 18 & 4 \quad 6 \\ \hline 2149 & 10 \quad 6 \end{array} = 2149\tfrac{7}{8} \text{ sq. ft.}$$

$$\underset{9}{\overset{\text{sq. ft.}}{}} \quad : \quad \underset{2149\tfrac{7}{8}}{\overset{\text{sq. ft.}}{}} \quad :: \quad \underset{\tfrac{1}{8}}{\overset{£}{}} \quad : \quad x$$

$$x = \frac{1}{9} \times \frac{17199}{8} \times \frac{1}{6} = £\frac{637}{16} = £39 \ 16s. \ 3d.$$

(9)...

$$\begin{array}{lll} \text{ch.} & \text{li.} & \text{ch.} \\ 7 & 75 & = 7{\cdot}75 \\ 5 & 25 & = 5{\cdot}25 \\ & & \overline{3875} \\ & & 1550 \\ & & 3875 \\ & & \overline{10)40{\cdot}6875} \text{ sq. chains} \\ & & \overline{4{\cdot}06875} \text{ ac.} \\ & & \qquad 4 \\ & & \overline{0{\cdot}27500} \text{ ro.} \\ & & \qquad 40 \\ & & \overline{11{\cdot}00000} \text{ per.} \end{array}$$

Area of field, 4 acres 11 perches

(10)...

$$\underset{4840}{\overset{\text{sq. yds.}}{}} \quad : \quad \underset{300\times121}{\overset{\text{yds. yds.}}{}} \quad :: \quad \underset{12}{\overset{s.}{}} \ \underset{6}{\overset{d.}{}} \quad : \quad x$$

$$\begin{array}{c} 12 \\ \hline 150 \end{array}$$

$$x = \frac{300 \times 121 \times 150}{4840} = 1125d. = £4 \ 13s. \ 9d.$$

## *EXERCISE X.*

(1)...An *arc* of a circle is any part of the circumference.

A *chord* is a straight line joining the extremities of an arc.

A *radius* of a circle is a straight line drawn from the centre to the circumference.

A *segment* of a circle is a figure contained by a straight line and the part of the circumference which it cuts off; or, more briefly, by an arc and its chord.

A *sector* of a circle is a figure contained by two radii and the included arc.

A *semicircle* is both a *segment* and a *sector*.

(2)...Diameter of circle : circumference of circle :: 1 : 3·1416

$$\text{Diameter of circle} = \overset{\textstyle 3\cdot1416}{\underset{}{\phantom{}}}\ 11 \text{ ft.}$$

Circumference of circle = $\overline{34\cdot5576}$ ft.

(3)...See "*Answers.*"

(4)...See Appendix, page 179, and "*Answers.*"

(5)...     Diameter of circle = 4 ft. 8 in. = 4⅔ ft.

Circumference = $3\cdot1416 \times 4\frac{2}{3} = 14\cdot6608$ ft.

Area = $\cdot7854 \times (4\frac{2}{3})^2 = 17\cdot1042$ sq. ft.

(6)...Circumference of circle = $3\cdot1416 \times 56 = 175\cdot9296$ yds.

$72° = \frac{1}{5}$ of circumference

∴ length of arc of $72° = 175\cdot9296 \div 5$

$= 35\cdot18592$ yds.

(7)...     $AD^2 = AB^2 - BD^2$

             $= 400 - 144$

             $= 256$

    $\therefore AD = 16$ ft.
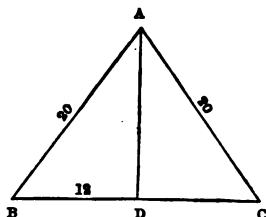
Area of triangle $= AD \times BD$

                $= 16$ ft. $\times 12$ ft.

                $= 192$ sq. ft.

Or thus,
```
        24              32 − 24 =  8
        20              32 − 20 = 12
        20              32 − 20 = 12
      2)64
        32
```

      $32 \times 8 \times 12 \times 12 = 36864$

Area of triangle $= \sqrt{36864} = 192$ sq. ft.

(8)...     $AC^2 = AB^2 + BC^2$

             $= (219)^2 + (292)^2$

             $= 47961 + 85264$

             $= 133225$

    $\therefore AC = \sqrt{133225}$

             $= 365$ yds.
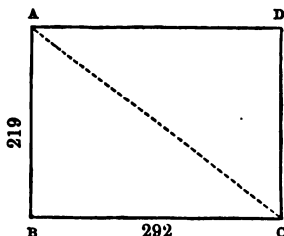
(9)...
|  | ft. | in. | ft. | in. | ft. | in. |  | ft. | ft. | ft. |
|---|---|---|---|---|---|---|---|---|---|---|
|  | 18 | 9 | $\times$ 16 | 4 | $\times$ 10 | 8 | $= 18\frac{3}{4}$ | $\times 16\frac{1}{3}$ | $\times 10\frac{2}{3}$ |

                      $= 3266\frac{2}{3}$ cu. ft.

(10)...          $2\frac{1}{2}$ acres = 12100 sq. yds.

Side of field = $\sqrt{12100}$ = 110 yds.

Perimeter of field = $110 \times 4$ = 440 yds.

440 yds. at 15d. per yard = £27 10s.


## EXERCISE XI.

<div align="center">links</div>

(1)...
<div align="center">

2775
1025
————
13875
5550
2775
————
2)2844375
————
14·22187$\frac{1}{2}$ ac.
4
————
0·88750 ro.
40
————
35·50000 per.

</div>

Area of field, 14 acres, 35$\frac{1}{2}$ perches


<div align="center">ft.</div>

(2)...
<div align="center">

41·625
16·875
————
208125
291375
333000
249750
41625
————
2)702·421875
————
9)351·2109375
————
39·0234375 sq. yds.

</div>

(3)...

ft.  in.
12   6
 1   4
————
12   6
 4   2
————
16   8 = 16⅔ sq. ft.

16⅔ sq. ft. at 1s. 9d. per foot = £1 9s. 2d.

(4)...

$$(11\tfrac{1}{4})^2 = (11\cdot25)^2 = 126\cdot5625$$
$$(6\tfrac{3}{4})^2 = (6\cdot75)^2 = 45\cdot5625$$
$$\overline{81}$$

Perpendicular of triangle $= \sqrt{81} = 9$ ft.

(5)...

$$(32)^2 = \begin{array}{r} \cdot7854 \\ 1024 \\ \hline 31416 \\ 15708 \\ 7854 \\ \hline 9)804\cdot2496 \end{array}$$

Area of enclosure = 89·3610 sq. yds.

(6)...  Circumference of wheel = 5280÷352 = 15 ft.

Radius of wheel = 15÷6·2832 = 2·387318 ft.

(7)...Area of each side of cube = 73½÷6 = 12¼ sq. in.

Edge of cube $= \sqrt{12\tfrac{1}{4}} = 3\tfrac{1}{2}$ in.

(8)...

$$25 \text{ ft.} + 32 \text{ ft.} = 57 \text{ ft.} = \begin{array}{r} \text{yds.} \\ 84 \\ 19 \\ \hline 2)1596 \\ \hline 798 \text{ sq. yds.} \end{array}$$

(9)...     Area of floor $= 27\frac{1}{2}$ ft. $\times 22\frac{1}{2}$ ft. $= 618\frac{3}{4}$ sq. ft.

Area of 1 yd. carpeting $=$ 3 ft. $\times 2\frac{1}{2}$ ft. $= 7\frac{1}{2}$ sq. ft.

Carpeting required $= 618\frac{3}{4} \div 7\frac{1}{2} = 82\frac{1}{2}$ yds.

$82\frac{1}{2}$ yds. at 3s. 9d. per yard $= £15$ 9s. $4\frac{1}{2}d.$

(10)...

$$\begin{array}{l} 200 \\ 300 \\ 400 \\ \hline 2)\overline{900} \\ \hline 450 \end{array}$$

$450 - 200 = 250$
$450 - 300 = 150$
$450 - 400 = \phantom{0}50$

$450 \times 250 \times 150 \times 50 = 843750000$

$\sqrt{843750000} = 29047$ sq. yds. $=$ 6 acres, 7 sq. yds.

### EXERCISE XII.

(1)...     Area of floor $= \overset{\text{yds.}}{27\frac{1}{2}} \times \overset{\text{yds.}}{20\frac{1}{4}} = \overset{\text{sq. yds.}}{556\frac{7}{8}} = \overset{\text{sq. in.}}{721710}$

Area of each brick $=$ 9 in. $\times 4\frac{1}{2}$ in. $= 40\frac{1}{2}$ sq. in.

No. of bricks required $= 721710 \div 40\frac{1}{2} = 17820$
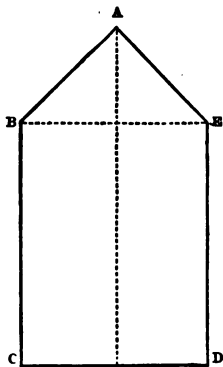


(2)...     Area of ABE $= \frac{1}{2}(32 \times 16)$
$=$ 256 sq. ft.

Area of BCDE $= 40 \times 32$
$=$ 1280 sq. ft.

Area of ABCDE $= 256 + 1280$
$=$ 1536 sq. ft.
$= 170\frac{2}{3}$ sq. yds.

(3)... $\overset{\text{sq. ft. in.}}{22\frac{2}{3}} + \overset{\text{sq. ft. ft.}}{10\frac{1}{2}} = 22\frac{2}{3} \div \frac{7}{8} = \dfrac{\overset{16}{\cancel{112}}}{5} \times \dfrac{8}{7} = \dfrac{128}{5} \text{ ft.} = 25\frac{3}{5} \text{ feet}$

(4)...

$$\overset{\text{ch. li.}}{17\ 45} = 17\cdot45$$
$$\overset{\text{ch.}}{10\ 16} = 10\cdot16$$
$$\overline{10470}$$
$$1745$$
$$1745$$
$$10\overline{)177\cdot2920}\text{ sq. chains}$$
$$\overline{17\cdot7292}\text{ ac.}$$
$$4$$
$$\overline{2\cdot9168}\text{ ro.}$$
$$40$$
$$\overline{36\cdot6720}\text{ per.}$$

Area of field = 17 ac. 2 ro. 36·672 per.

(5)...  Area of roof = $37\frac{2}{3}$ ft. $\times 25\frac{1}{2}$ ft. = $960\frac{1}{2}$ sq. ft.
Weight of lead = $960\frac{1}{2} \times 6\frac{1}{4} = 6003\frac{1}{8}$ lb.
$= 2$ tons, 13 cwt. 2 qrs. $11\frac{1}{8}$ lb.

(6)...    $AD^2 = AB^2 - BD^2$
    $= 144 - 36$
    $= 108$



$\therefore AD = \sqrt{108}$
    $= 10\cdot3923$ feet
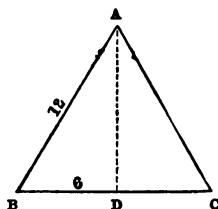
Area of triangle ABC $= AD \times BD$
    $= 10\cdot3923$ ft. $\times 6$ ft.
    $= 62\cdot3538$ sq. ft.

thus,  12            $18 - 12 = 6$
    12
    12        $18 \times 6 \times 6 \times 6 = 3888$
    2$\overline{)36}$
    $\overline{18}$    Area of triangle $= \sqrt{3888}$
            $= 62\cdot3538$ sq. ft.

D D

(7)...    125 yds. × 13 ft. = 541⅔ sq. yds. = 17 po. 27₁₃⁵ sq. yds.

|  | ac. | ro. | po. | yds. |
|---|---|---|---|---|
| Area of plantation ... | 17 | 0 | 0 | 0 |
| Area of carriage-drive | 0 | 0 | 17 | 27₁₂⁵ |

16 a.  3 r. 22 p.  2⅝ yds.

(8)...      181 sq. ft. 36 sq. in. = 26100 sq. in.
            21 ft. 9 in. = 261 in.

in.
Height of triangle = (26100 ÷ 261) × 2 = 200 = 16 ft. 8 in.

(9)...
$$
\begin{array}{cc}
\text{ft.} & \text{in.} \\
7 & 6 \\
3 & 6 \\
\hline
22 & 6 \\
3 & 9 \\
\hline
26 & 3 \\
 & 2 \\
\hline
52 & 6 \\
\end{array}
$$

52  6 = 52½ sq. ft. = 5⅚ sq. yds.

5⅚ sq. yds. at 9d. per yd. = 4s. 4½d.

(10)...        12 yds. 1 ft. 1½ in. = 12¾ yds.

yds.       sq. yds.        sq. yds.
Area of ground = (12¾)² = 153⁹⁄₆₄ = 153·140625

sq. yds.   sq. yds.
1 acre = 4840)153·140625(·031640625 of an acre
            14520
            ─────
             7940
             4840
            ─────
            31006
            29040
            ─────
            19662
            19360
            ─────
             30250
             29040
             ─────
             12100
              9680
             ─────
             24200
             24200

## EXERCISE XIII.

**(1)...**
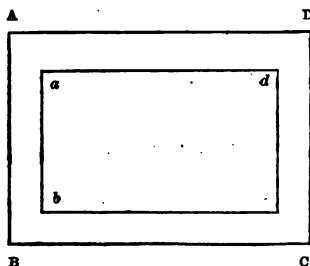


Area of frame $= ABCD - abcd$

$= (38 \times 26) - (30 \times 18)$

$= 988 - 540$

$= 448$ sq. in.

$= 3$ sq. ft. 16 sq. in.

**(2)...**

```
    450          900 - 450 = 450
    600          900 - 600 = 300
    750          900 - 750 = 150
  2)1800
    900
```

$900 \times 450 \times 300 \times 150 = 18225000000$

$\sqrt{18225000000} = 135000$ sq. links $= 1$ ac. 1 ro. 16 per.

**(3)...**

```
                    ft.  in.
                    3    9
                    2    3
                    7    6
                        11   3
Area of each pane   8    5   3
                             8
Area of window     67    6   0  = 67½ sq. ft.
```

67½ sq. ft. at 2s. 9d. per foot $= £9$ 5s. 7½d.

D D 2

(4)...    Area of floor $= 19\frac{1}{2}$ ft. $\times 16\frac{1}{2}$ ft. $= 321\frac{3}{4}$ sq. ft.

Area of 1 yd. carpeting $= 3$ ft. $\times 1\frac{5}{6}$ ft. $= 5\frac{1}{2}$ sq. ft.

Carpeting required $= 321\frac{3}{4} \div 5\frac{1}{2} = 58\frac{1}{2}$ yds.

$58\frac{1}{2}$ yds. at 4s. 9d. per yd. $= £13$ 17s. $10\frac{1}{2}d.$

(5)...    Contents of wall $= 175$ yds. $\times 12$ ft. $\times 1$ ft. $10\frac{1}{2}$ in.

$\qquad\qquad\qquad = 6300$ in. $\times 144$ in. $\times 22\frac{1}{2}$ in.

$\qquad\qquad\qquad = 20412000$ cu. in.

Contents of each brick $= 9$ in. $\times 4\frac{1}{2}$ in. $\times 3$ in. $= 121\frac{1}{2}$ cu. in.

No. of bricks required $= 20412000 \div 121\frac{1}{2} = 168000$

(6)...    Contents of block $= 18$ ft. $\times 2\frac{1}{4}$ ft. $\times 1\frac{2}{3}$ ft. $= 67\frac{1}{2}$ cu. ft.

$\qquad\qquad 2\frac{1}{4}$ ft. $\times 1\frac{2}{4}$ ft. $= 4\frac{3}{8}$ sq. ft.

$$67\frac{1}{2} \text{ cu. ft.} \div 4\frac{3}{8} \text{ sq. ft.} = \frac{\overset{27}{\cancel{135}}}{\cancel{2}} \times \frac{\overset{4}{\cancel{8}}}{\underset{7}{\cancel{35}}} = \frac{108}{7} = 15\frac{3}{7} \text{ ft.}$$

(7)... 
$$\overset{\text{sq. yds.}}{4840} \; : \; \overset{\text{yds. yds.}}{75 \times 68} \; :: \; \overset{£}{75} \; : \; x$$

$$x = \frac{\overset{15}{\cancel{75}} \times \overset{17}{\cancel{68}} \times 75}{\underset{\underset{242}{968}}{\cancel{4840}}} = £\frac{19125}{242} = £79 \ 0s. \ 6\frac{11}{14}d.$$

(8)... 
$$\overset{\text{ft.}}{(12\frac{1}{2})^2} = \overset{\text{sq. ft.}}{156\cdot25}$$

$$\overset{\text{sq. ft.}}{156\cdot25} \times \cdot7854 = 122\cdot71875 \text{ sq. ft.}$$

$$= 122 \text{ sq. ft. } 103\frac{1}{2} \text{ sq. in.}$$

(9)... £6 16s. 1½d. + 6d. = 272¼ sq. yds. = area of yard

$$\sqrt{272\tfrac{1}{4}} = \sqrt{\tfrac{1089}{4}} = \tfrac{33}{2} = 16\tfrac{1}{2} \text{ yds., length of side}$$

(10)...
$$36^2 = 1296$$
$$34^2 = \underline{1156}$$
$$\overline{\phantom{000}140}$$

$\sqrt{140}$ = 11·832 ft., distance of foot of ladder from building

## EXERCISE XIV.

(1)...
ft. in.    in.
$$(7\ 1)^2 = (85)^2 = 7225$$
$$(5\ 8)^2 = (68)^2 = 4624$$
$$\overline{\phantom{0000000}2601}$$

Perpendicular = $\sqrt{2601}$ = 51 in. = 4 ft. 3 in.

ft. in.
5  8
4  3
‾‾‾‾‾
22  8
1  5
‾‾‾‾‾
2)24  1

Area of triangle = 12  0  6 = 12 sq. ft. 6 sq. in.

(2)... Area of roof =
ft. in.  ft. in.  in.   in.   sq. in.
38 6 × 23 4 = 462 × 280 = 129360

Area of each slate = 14 in. × 10 in. = 140 sq. in.

No. of slates required = 129360 ÷ 140 = 924

sl.       sl.      £ s.     £ s.  d.
1000  :  924  ::  3 3  :  2 18 $2\tfrac{69}{125}$ .

<pre>
                        ft.  in.
(3)...                   8   4
                         3  10
                        25   0
                         6  11   4
                        31  11   4
                         3   3
                        95  10   0
                         7  11  10
                       103   9  10  = 103 cu. ft. 1416 cu. in.
</pre>

(4)...  Area of field $= \frac{1}{2}(144 \times 144) = 10368$ sq. yds.

Length of side $= \sqrt{10368} = 101.8233$ yds.

(5)...     Area of field $= \frac{1}{2}(150 \times 150) = 11250$ sq. yds.

$= 2$ ac. 1 ro. 11 per. $27\frac{1}{4}$ sq. yds.
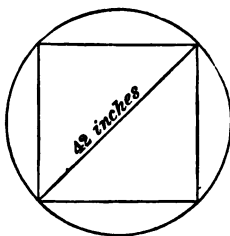


(6)...The diameter of the circle is the diagonal of the square, and is therefore equal to the side of a square double the size of the inscribed square.

Hence, the area of the inscribed square

$= \frac{1}{2}(42 \times 42) = 882$ sq. in.

Area of the circle $= (42)^2 \times .7854$

$= 1385.4456$ sq. in.

∴ the area of the remainder $= 503.4456$ sq. in.

(7)... See Appendix, page 179.

$$
\begin{array}{ccc}
\text{ft. in.} & & \text{ft. in.} \\
(3 \quad 6)^2 & : & (5 \quad 10)^2 \\
42^2 & : & 70^2 \\
4\!\!\!/7 \times 4\!\!\!/7 & : & 7\!\!\!/0 \times 7\!\!\!/0 \\
3 \times 3 & : & 5 \times 5 \\
9 & : & 25
\end{array}
$$

(8)...Contents of block $= 3$ ft. $\times 2$ ft. $\times 18$ in. $= 9$ cu. ft.

$$= 15552 \text{ cu. in.}$$

Contents of each required cube $= 3^3 = 27$ cu. in.

No. of cubes $= 15552 \div 27 = 576$

(9)...

$$
\begin{array}{cc}
\text{ft.} & \text{in.} \\
22 & 6 \\
16 & 6 \\
\hline
39 & 0 \\
& 2 \\
\hline
\end{array}
$$

Perimeter of room $= \overline{78 \quad 0}$
Height of room $= 11 \quad 3$

$$
\begin{array}{cc}
\hline
858 & 0 \\
19 & 6 \\
\hline
\end{array}
$$

Area of walls $= \overline{877 \quad 6} = 877\frac{1}{2}$ sq. ft. $= 97\frac{1}{2}$ sq. yds.

$97\frac{1}{2}$ sq. yds. at $7\frac{1}{2}d.$ per yd. $= £3$ $0s.$ $11\frac{1}{4}d.$

(10)...        $12\frac{1}{2}$ ft. $\times 5$ ft. $\times 6\frac{1}{2}$ ft. $= 406\frac{1}{4}$ cu. ft.

## EXERCISE XV.

(1)...
Area of rectangular field $= 504$ yds. $\times 126$ yds. $= 63504$ sq. yds.

Side of square field $= \sqrt{63504} = 252$ yds.

(2)...

$$
\begin{array}{r}
\text{ft.} \quad \text{ft.} \qquad \text{ft.} \quad \text{in.} \\
19+23 = 42 \quad 0 \\
7 \quad 6 \\
\hline
294 \quad 0 \\
21 \quad 0 \\
\hline
2)315 \quad 0 \\
\hline
157 \quad 6 = 157\tfrac{1}{2} \text{ sq. ft.}
\end{array}
$$

(3)...

$$
\begin{array}{r}
68^2 = 4624 \\
51^2 = 2601 \\
\hline
7225
\end{array}
$$

Diagonal $= \sqrt{7225} = 85$ yds.

(4)...
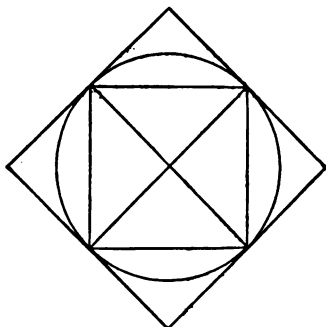


The area of the circumscribed square is double the area of the inscribed square.

$$
\begin{array}{c}
\text{sq. yds.} \qquad \text{sq. yds.} \\
12\tfrac{1}{4} \times 2 = 24\tfrac{1}{2}
\end{array}
$$

(5)...

$$
\begin{array}{ll}
800 & 1450- \ 800 = 650 \\
900 & 1450- \ 900 = 550 \\
1200 & 1450-1200 = 250 \\
\cline{1-1}
2)2900 \\
\cline{1-1}
1450
\end{array}
$$

$1450 \times 650 \times 550 \times 250 = 129593750000$

$\sqrt{129593750000} = 359991$ square links
$= 3$ ac. 2 ro. 15·98 per.

(6)...  Area of floor $= 17\frac{1}{2}$ ft. $\times 13\frac{2}{3}$ ft. $= 239\frac{1}{6}$ sq. ft.

Area of 1 yd. carpeting $= 3$ ft. $\times 2\frac{1}{4}$ ft. $= 6\frac{3}{4}$ sq. ft.

Carpeting required $= 239\frac{1}{6} \div 6\frac{3}{4} = 35\frac{35}{81}$ yds.

(7)...  See Appendix, page 179.

Area of circle $= 25^2 \times \cdot07958$

$= 625 \times \cdot07958$

$= 49\cdot7375$ sq. ft.

(8)...
$$
\begin{array}{r r}
\text{ft.} & \text{in.} \\
5 & 3 \\
2 & 8 \\
\hline
10 & 6 \\
3 & 6 \\
\hline
14 & 0 \\
1 & 10 \\
\hline
14 & 0 \\
11 & 8 \\
\hline
25 & 8 \\
\end{array}
$$
$= 25$ cu. ft. 1152 cu. in.

(9)...  See figure in *Exercise X.* (7)

Perp. of triangle $= \sqrt{(13\frac{1}{2})^2 - (4\frac{1}{2})^2}$

$= \sqrt{182\cdot25 - 20\cdot25}$

$= \sqrt{162}$

$= 12\cdot7279$ ft.

Area of triangle $= 12\cdot7279$ ft. $\times 4\cdot5$ ft.

$= 57\cdot27555$ sq. ft.

(10)...  $\frac{3}{8}$ mile $= 660$ yds.

8 ft. 3 in. $\times 2 = 16\frac{1}{2}$ ft. $= 5\frac{1}{2}$ yds.

660 yds. $\times 5\frac{1}{2}$ yds. $= 3630$ sq. yds.

3630 sq. yds. at 3s. 3d. per yd. $= £589$ 17s. 6d.

## *EXERCISE XVI.*

(1)...
$$
\begin{array}{r}
\text{ch.} \\
10 \text{ ch. } 45 \text{ li.} = 10\cdot45 \\
3 \text{ ch. } 75 \text{ li.} + 4 \text{ ch. } 25 \text{ li.} = \phantom{0}8 \\
\hline
2)\overline{83\cdot60} \\
\hline
10)\overline{41\cdot80} \text{ sq. chains} \\
\hline
4\cdot18 \text{ ac.} \\
4 \\
\hline
\cdot72 \text{ ro.} \\
40 \\
\hline
28\cdot8 \text{ po.}
\end{array}
$$

Area of field = 4 ac. 28·8 po.

(2)...    39 sq. yds. $3\frac{3}{4}$ sq. ft. = $354\frac{3}{4}$ sq. ft.

Length of shorter side = $354\frac{3}{4}$ sq. ft. $\div 21\frac{1}{2}$ ft. = $16\frac{1}{2}$ ft.

(3)...$5\frac{1}{4}$ ft. $\times 2\frac{1}{3}$ ft. = $12\frac{1}{4}$ sq. ft.    $6\frac{1}{3}$ ft. $\times 2\frac{3}{4}$ ft. = $17\frac{5}{12}$ sq. ft.

$$
\begin{array}{ccccccc}
\text{sq. ft.} & & \text{sq. ft.} & & s. \quad d. & d. & \\
12\frac{1}{4} & ; & 17\frac{5}{12} & :: & 12 \quad 3 = 147 & : & x
\end{array}
$$

$$
x = \frac{\cancel{4}}{\cancel{49}} \times \frac{209}{\cancel{12}} \times \frac{\cancel{147}}{1} = 209d. = 17s. \; 5d.
$$

(4)...    $ES^2 = OE^2 + OS^2$
     $= (112\cdot5)^2 + (150)^2$
     $= 12656\cdot25 + 22500$
     $= 35156\cdot25$

$ES = 187\cdot5 = 187\frac{1}{2}$ miles
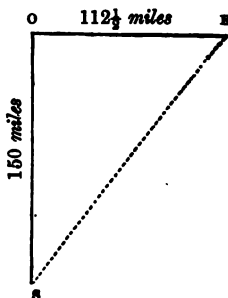
(5)...   Area of room $= 25\frac{1}{2}$ ft. $\times 18\frac{2}{3}$ ft. $= 476$ sq. ft.

Area of 1 yd. carpeting $= 3$ ft. $\times 2\frac{1}{3}$ ft. $= 7$ sq. ft.

Carpeting required $= 476 \div 7 = 68$ yds.

68 yds. at 4s. 9d. per yd. $= £16$ 3s.


(6)...Contents of each plank $= 13\frac{1}{2}$ ft. $\times 10\frac{1}{2}$ in. $= 11\frac{13}{16}$ sq. ft.

Area of platform $= 54$ yds. $\times 21$ yds. $= 1134$ sq. yds.

$= 10206$ sq. ft.

No. of planks required $= 10206 \div 11\frac{13}{16} = 864$

Cost, 10206 sq. ft. at $5\frac{1}{2}d$. per ft. $= £233$ 17s. 9d.


(7)...       Diameter of pond $= 250$ yds. $\div 3\cdot1416$

$= 79\cdot577$ yds.


(8)...       $10\frac{1}{2}$ ft. $\times 9$ ft. $\times 3\frac{1}{3}$ ft. $= 315$ cu. ft.

$= 11$ cu. yds. 18 cu. ft.


(9)...  Area of field $= 2$ ac. 3 ro. 1 per. $= 441$ perches

Length of side $= \sqrt{441} = 21$ perches $= 115\frac{1}{2}$ yds.


(10)...   Area of two sides,  $6\frac{1}{3}$ ft. $\times 2\frac{2}{3}$ ft. $\times 2 =$   sq. ft.   $33\frac{7}{9}$

Area of two ends,  $3\frac{1}{4}$ ft. $\times 2\frac{2}{3}$ ft. $\times 2 = 17\frac{1}{3}$

Area of bottom,   $6\frac{1}{3}$ ft. $\times 3\frac{1}{4}$ ft.   $= 20\frac{7}{12}$

$\overline{71\frac{25}{36}}$ sq. ft.

$71\frac{25}{36} \times 6\frac{1}{2} = 466\frac{1}{2}$ lb. $= 4$ cwt. $18\frac{1}{12}$ lb.

## EXERCISE XVII.

(1)...      Area of rectangle = 50 yds. × 30·96845 yds.

                     = 1548·4225 sq. yds.

Side of square = $\sqrt{1548\cdot4225}$ = 39·35 yds.

(2)...   Area of room = $23\frac{2}{3}$ ft. × $19\frac{1}{2}$ ft. = $461\frac{1}{3}$ sq. ft.

Area of 1 yd. carpeting = $461\frac{1}{3}$ sq. ft. ÷ 71 = $6\frac{1}{2}$ sq. ft.

Width of carpeting = $6\frac{1}{2}$ sq. ft. ÷ 3 ft. = $2\frac{1}{6}$ ft. = 2 ft. 2 in.

(3)...

```
              ft.  ′   ″
             ·17   8   4
              13   9   7
            ─────────────
             230   0   4
              13   3   3   0
                  10   3  10   4
            ────────────────────
          2)244   1  10  10   4
```

Area of triangle = 122ft. 0′ 11″ 5‴ 2‴′

(4)...        $121\frac{1}{2}$ miles = 641520 ft.

641520 ft. × $30\frac{1}{4}$ ft. = 19405980 sq. ft. = $445\frac{1}{2}$ acres

$445\frac{1}{2}$ acres at £72 per acre = £32076

(5)...

```
                    ft.  in.
                    22   10
                    17    8
                   ─────────
                    40    6
                          2
Perimeter of room =  81    0
Height of room... =  10    4
                   ─────────
                   810    0
                    27    0
                 9)837    0
                   ─────────
Area of walls  =   93    0 sq. yds.
```

(6)...    6 ft. 4 in. × 2 ft. 6 in. × 2 in. = $2\frac{33}{36}$ cu. ft.

$2\frac{33}{36}$ cu. ft. at 16$s$. 6$d$. per cu. ft. = £2 3$s$. $6\frac{1}{2}d$.

(7)...    Area of bottom = $7\frac{1}{2}$ ft. × $3\frac{1}{6}$ ft. = $23\frac{3}{4}$ sq. ft.

Required depth, 76 cu. ft. ÷ $23\frac{3}{4}$ sq. ft. = $3\frac{1}{5}$ ft.

(8)...
```
ft.   ft.    ft.
42 + 52 = 94
         38¼
        ────
         752
        282
         23½
      ──────
     2)3595½
     9)1797¾ sq. ft.
       ────
       199¾ sq. yds.
```
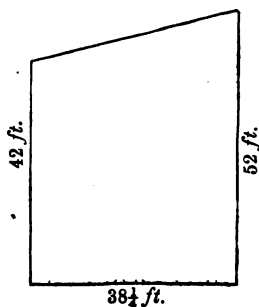


(9)...
```
           ft.      ·7854
        (45)² =     225 sq. yds.
                  ─────
                  39270
                  15708
                  15708
Area of pond = 176·7150 sq. yds.
```

(10)...
```
            12³    :   18³
        12 × 12 × 12  :  18 × 18 × 18
         2 × 2 × 2  :   3 × 3 × 3
              8     :   27
```

### EXERCISE XVIII.

(1)...    $60\frac{157}{162}$ sq. yds. = $548\frac{13}{18}$ sq. ft.

Length of room, $548\frac{13}{18}$ sq. ft. ÷ $19\frac{2}{3}$ ft. = $27\frac{2}{3}$ ft. = 27 ft. 8 in.

(2)...    1250        $2150-1250 = 900$
          1400
          1650        $2150-1400 = 750$
        2)4300
        ───────     $2150-1650 = 500$
          2150

$$2150 \times 900 \times 750 \times 500 = 725625000000$$

$$\sqrt{725625000000} = 851836 \text{ sq. links} = 8 \text{ ac. } 2 \text{ ro. } 2\cdot9 \text{ po.}$$

(3)...    Area of room $= 35 \text{ ft.} \times 24\frac{3}{4} \text{ ft.} = 866\frac{1}{4}$ sq. ft.

Area of 1 yd. carpeting $= 3 \text{ ft.} \times 2\frac{1}{4} \text{ ft.} = 6\frac{3}{4}$ sq. ft.

Carpeting required $= 866\frac{1}{4} \div 6\frac{3}{4} = 128\frac{1}{3}$ yds.

$128\frac{1}{3}$ yds. at $3s.$ $9d.$ per yd. $= £24$ $1s.$ $3d.$

(4)...51 sq. ft. 6 sq. in. $= 7350$ sq. in.    11 ft. 8 in.$=140$ in.

Base of triangle $= (7350 \div 140) \times 2 = 105$ in.

$$\text{Hypotenuse} = \sqrt{140^2 + 105^2}$$
$$= \sqrt{19600 + 11025}$$
$$= \sqrt{30625}$$
$$= 175 \text{ in.} = 14 \text{ ft. } 7 \text{ in.}$$

(5)...

|                          | ft. | in. |
|--------------------------|-----|-----|
|                          | 13  | 6   |
|                          | 3   | 2   |
|                          | 40  | 6   |
|                          | 2   | 3   |
| Surface of each pillar   | 42  | 9   |
|                          |     | 12  |
|                          | 9)513 | 0 |
| Surface of 12 pillars    | 57  | 0   | sq. yds.

57 sq. yds. at $6\frac{1}{2}d.$ per sq. yd. $= £1$ $10s.$ $10\frac{1}{2}d.$

(6)...
$$
\begin{array}{c}
\text{ft.} \qquad \text{sq. ft.} \\
(7{\cdot}5)^2 = 56{\cdot}25 \\
{\cdot}7854 \\
\hline
2250\overline{0} \\
28125 \\
45000 \\
39375 \\
\hline
\end{array}
$$

Area of circle $= \overline{44{\cdot}178750}$ sq. ft.

(7)...　　18 cu. ft. 1664 cu. in. $=$ 32768 cu. in.

Edge of cube $= \sqrt[3]{\overline{32768}} = 32$ in. $= 2$ ft. 8 in.

$$
\begin{array}{ccc}
\text{ft.} & \text{in.} & \\
2 & 8 & \\
2 & 8 & \\
\hline
5 & 4 & \\
1 & 9 & 4 \\
\hline
7 & 1 & 4 \\
& & 6 \\
\hline
\end{array}
$$

Surface of cube $= \overline{42 \quad 8 \quad 0} = 42$ sq. ft. 96 sq. in.

(8)...　　Diagonal path $= \sqrt{(213^2 + (159{\cdot}75)^2}$

$\qquad = \sqrt{45369 + 25520{\cdot}0625}$

$\qquad = \sqrt{70889{\cdot}0625}$

$\qquad = 266{\cdot}25 = 266\frac{1}{4}$ yds.

(9)...　　$2\frac{1}{2}$ acres $= 12100$ sq. yds.

Perimeter of field $= \sqrt{12100} \times 4 = 110$ yds. $\times 4 = 440$ yds.

No. of hurdles required, $440 \div 2\frac{1}{2} = 176$

176 hurdles at 17s. 6d. per dozen $= £12$ 16s. 8d.

(10)...    See figure in *Exercise XII.* (6)

$$\text{Perp. of triangle} = \sqrt{(13\cdot5)^2 - (6\cdot75)^2}$$
$$= \sqrt{182\cdot25 - 45\cdot5625}$$
$$= \sqrt{136\cdot6875}$$
$$= 11\cdot69134 \text{ ft.}$$
$$\text{Area of triangle} = 11\cdot69134 \text{ ft.} \times 6\cdot75 \text{ ft.}$$
$$= 78\cdot9165 \text{ sq. ft.}$$

## EXERCISE XIX.

1)...        Area of floor, $79\frac{1}{6}$ yds. $= 712\frac{1}{2}$ sq. ft.

ength of room, $712\frac{1}{2}$ sq. ft. $\div 22\frac{1}{2}$ ft. $= 31\frac{2}{3}$ ft. $= 31$ ft. 8 in.

2)...Area of yard, $\overset{\text{yds.}}{56\frac{1}{4}} \times \overset{\text{yds.}}{47\frac{1}{2}} = \overset{\text{in.}}{2025} \times \overset{\text{in.}}{1710} = \overset{\text{sq. in.}}{3462750}$

No. of stones required $= 3462750 \div 225 = 15390$

(3)...        $12\frac{1}{2}$ chains $= 12\cdot5$ chains
$$12\cdot5$$
$$\overline{625}$$
$$250$$
$$125$$
$$10\overline{)156\cdot25} \text{ sq. chains}$$
$$\overline{15\cdot625} \text{ ac.}$$
$$4$$
$$\overline{2\cdot500} \text{ ro.}$$
$$40$$
$$\overline{20\cdot000} \text{ po.} \qquad 15 \text{ ac. } 2 \text{ ro. } 20 \text{ po.}$$

(4)...   Area of walls $= (\overset{\text{ft.}}{24} + \overset{\text{ft.}}{19}) \times 2 \times 10 = 860$ sq. ft.

Area of ceiling $= 24$ ft. $\times 19$ ft. $= 456$ sq. ft.

$$\overset{\text{sq. ft.}}{860} + \overset{\text{sq. ft.}}{456} = \overset{\text{sq. ft.}}{1316} = 146\frac{2}{9} \text{ sq. yds.}$$

(5)... Perimeter of ground, $\overset{\text{yds.}}{(123} + \overset{\text{yds.}}{82)} \times 2 = 410$ yards

Length of each hurdle $= \overset{\text{yds.}}{410} \div 180 = 2\frac{5}{18}$ yds. $= 6$ ft. $10$ in.

(6)... Contents of stack $= \overset{\text{yds.}}{25} \times \overset{\text{yds.}}{16\frac{1}{2}} \times \overset{\text{ft.}}{17\frac{1}{2}} = \overset{\text{cu. in.}}{112266000}$

Contents of each brick $= 9$ in. $\times 4\frac{1}{2}$ in. $\times 3$ in. $= 121\frac{1}{2}$ cu. in.

No. of bricks $= 112266000 \div 121\frac{1}{2} = 924000$

(7)...Contents of each plank, $13\frac{1}{2}$ ft. $\times 1\frac{1}{8}$ ft. $\times \frac{1}{8}$ ft. $= 1\frac{31}{32}$ cu. ft.

$$34 \text{ lb. } 6 \text{ oz. } = 34\frac{3}{8} \text{ lb.}$$

$$\overset{\text{cu. ft.}}{1} \quad : \quad \overset{\text{cu. ft.}}{1\frac{31}{32} \times 36} \quad :: \quad \overset{\text{lb.}}{34\frac{3}{8}} \quad : \quad x$$

$$x = \frac{63}{32} \times \frac{36}{1} \times \frac{275}{8} = \frac{155925}{64} \text{lb.} = 1 \text{ ton } 1 \text{ cwt. } 3 \text{ qrs. } 0 \text{ lb. } 5\frac{1}{4} \text{oz.}$$

(8)... Diameter $= \overset{\text{yds.}}{325} \div 3\cdot1416 = 103\cdot4504$ yards

(9)... 15 chains, 65 links $= 15\cdot65$ chains
$\quad$ 8 $\quad$ „ $\quad$ 42 $\quad$ „ $\quad = \quad 8\cdot42 \quad$ „

$$
\begin{array}{r}
3130 \\
6260 \\
12520 \\
\hline
2)131\cdot7730 \\
\hline
10)\ 65\cdot8865 \quad \text{sq. chains} \\
\hline
6\cdot58865 \text{ ac.} \\
4 \\
\hline
2\cdot35460 \text{ ro.} \\
40 \\
\hline
14\cdot18400 \quad 6 \text{ ac. } 2 \text{ ro. } 14\cdot184 \text{ po.}
\end{array}
$$

E E

(10)...   $7\frac{3}{4}$ ft. $\times 4\frac{1}{3}$ ft. $\times 3\frac{1}{2}$ ft. $= 117\frac{13}{24}$ cu. ft.

$= 117$ cu. ft. 936 cu. in.

## EXERCISE XX.

(1)...The *complement* of an angle is its deficiency from a right angle.

| 90° | 0′ | 0″ | | 90° | 0′ | 0″ |
|---|---|---|---|---|---|---|
| 67° | 25′ | 45″ | | 25° | 18′ | 34·45″ |
| Comp. $= 22°$ | 34′ | 15″ | Comp. $= 64°$ | 41′ | 25·55″ |

(2)...The *supplement* of an angle is its deficiency from two right angles.

| 180° | 0′ | 0″ | | 180° | 0′ | 0″ |
|---|---|---|---|---|---|---|
| 53° | 15′ | 45″ | | 125° | 25′ | 36″ |
| Supp. $= 126°$ | 44′ | 15″ | Supp. $= 54°$ | 34′ | 24″ |

(3)...   $1\frac{1}{4}$ mile $= 2200$ yds.     7 furlongs $= 1540$ yds.

2200 yds. $\times 1540$ yds. $= 338800$ sq. yds. $= 700$ acres

(4)...   Perimeter of rectangular field $= (\overset{\text{yds.}}{625} + \overset{\text{yds.}}{289}) \times 2 = \overset{\text{yds.}}{1828}$

Side of square field $= \sqrt{625 \times 289}$

$= \sqrt{180625}$

$= 425$ yards

Perimeter of field $= 1700$   „

∴ the perimeter of the rectangular field is 128 yards more than that of the square field.

(5)...    Top and bottom of box $= 5\frac{1}{3} \times 3\frac{1}{2} \times 2 = 37\frac{1}{3}$
               Two sides $= 5\frac{1}{3} \times 2\frac{1}{2} \times 2 = 26\frac{2}{3}$
               Two ends $= 3\frac{1}{2} \times 2\frac{1}{2} \times 2 = 17\frac{1}{2}$
        Quantity of board required $= 81\frac{1}{2}$ sq. ft.

(6)...       Area of field $= (\overset{\text{yds.}}{420})^2 \div 2$

                        $= 88200$ sq. yds.

                        $= 18$ ac. 35 po. $21\frac{1}{4}$ sq. yds.

(7)...   By Duodecimals :—

                  ft.  in.
                  22   6
                   1   3
                  ‾‾‾‾‾‾‾
                  22   6
                   5   7   6
                  ‾‾‾‾‾‾‾‾‾‾‾
                  28   1   6
                       9
                  ‾‾‾‾‾‾‾‾‾‾‾‾‾
                  21   1   1   6 = 21 cu. ft. 162 cu. in.

By Vulgar Fractions :—

$\overset{\text{ft.}}{22\frac{1}{2}} \times \overset{\text{ft.}}{1\frac{1}{4}} \times \overset{\text{ft.}}{\frac{3}{4}} = \frac{45}{2} \times \frac{5}{4} \times \frac{3}{4} = \overset{\text{cu. ft.}}{\frac{675}{32}} = 21\frac{3}{32}$ cu. ft.

By Decimal Fractions :—

        22 ft. 6 in. $= 22\cdot5$ ft.
         1 ft. 3 in. $= 1\cdot25$ ft.
                      ‾‾‾‾‾‾
                      1125
                       450
                       225
                      ‾‾‾‾‾‾
                      28·125
        9 in. $=$      ·75 ft.
                      ‾‾‾‾‾‾‾
                      140625
                      196875
                      ‾‾‾‾‾‾‾
                      21·09375 cu. ft.
                      E E 2

(8)...

<div style="text-align:center">

ft.  yds.  ·7854

$(150)^2 = (50)^2 =$ 2500

$\overline{3927000}$

15708

$\overline{1963\text{·}5000}$ = $1963\frac{1}{2}$ sq. yds.

</div>

(9)...



Area of ring = $(45+40) \times (45-40) \times \text{·}7854$

(with "ft. ft.   ft. ft." labels above the terms)
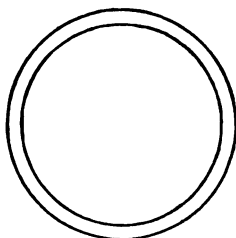
= 85 ft. × 5 ft. × ·7854

= 425 sq. ft. × ·7854

= 333·795 sq. ft.

(10)...

yds. ft. in.   yds. ft. in.   bricks

$250 \times 8 \times 13\frac{1}{2}$ : $880 \times 9 \times 18$ :: 96000 : $x$

  2        2

 $\overline{27}$       $\overline{36}$

$$x = \frac{880 \times 9 \times 36 \times 96000}{250 \times 8 \times 27} = 506880 \text{ bricks}$$

(with cancellations: 110, 12, 384 above numerator; 3 below denominator)

## EXERCISE XXI.

**(1)...**

$$cd = 15 - (10\tfrac{1}{2} \times 2) = 15 - 1\tfrac{3}{4} = 13\tfrac{1}{4}$$

(with units: ft., in., ft., ft., ft.)

2 shelves, each $18\tfrac{1}{2}$ long $= 37$ (ft.)

2　,,　,,　$13\tfrac{1}{4}$ long $= 26\tfrac{1}{2}$ (ft.)

Length of board required $= \overline{63\tfrac{1}{2}}$ ft.

$$63\tfrac{1}{2} \text{ ft.} \times \tfrac{7}{8} \text{ ft.} = 55\tfrac{9}{16} \text{ sq. ft.}$$
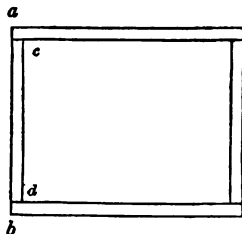
$$55\tfrac{9}{16} \text{ sq. ft. at } 8d. \text{ per sq. ft.} = £1 \ 17s. \ 0\tfrac{1}{2}d.$$

**(2)...**

$$(7)^2 + (8\tfrac{1}{2})^2 + (9)^2 = 49 + 72\tfrac{1}{4} + 81 = 202\tfrac{1}{4}$$

(with units: ft., ft., ft., sq. ft., sq. ft., sq.ft., sq. ft.)

$$\text{Side of required square} = \sqrt{202\cdot25}$$

$$= 14\cdot2214 \text{ ft.}$$

**(3)...**　Area of floor $= 18\tfrac{3}{4}$ ft. $\times 15$ ft. $= 281\tfrac{1}{4}$ sq. ft.

Area of 1 yd. carpeting $= 3$ ft. $\times 1\tfrac{7}{8}$ ft. $= 5\tfrac{5}{8}$ sq. ft.

Carpeting required $= 281\tfrac{1}{4} \div 5\tfrac{5}{8} = 50$ yds.

50 yds. at $5s.$ $3d.$ per yd. $= £13 \ 2s. \ 6d.$

**(4)...**　Length of ground $= 7\tfrac{1}{4}$ ft. $\times 42 = 304\tfrac{1}{2}$ ft.

Breadth of　,,　$= 7\tfrac{1}{4}$ ft. $\times 26 = 188\tfrac{1}{2}$ ft.

Area $= 304\tfrac{1}{2}$ ft. $\times 188\tfrac{1}{2}$ ft. $= 57398\tfrac{1}{4}$ sq. ft.

$= 1$ acre 1 rood 10 per. 25 sq. yds. 108 sq. in.

(5)...See Euclid, Book I. Prop. xxxii. Cor. 1.

$$\text{6 angles of hexagon} + 4 \text{ rt. angles} = 12 \text{ rt. angles}$$
$$\text{6 angles of hexagon} = 8 \text{ rt. angles}$$
$$\text{each angle of hexagon} = \tfrac{4}{3} \text{ of a rt. angle}$$
$$= \tfrac{4}{3} \text{ of } 90°$$
$$= 120°$$

(6)...

$$1 \text{ acre} = 4840 \text{ sq. yds.}$$
$$\text{Diameter of pool} = \sqrt{4840 \div \cdot 7854}$$
$$= \sqrt{6162 \cdot 46498599}$$
$$= 78 \cdot 5013 \text{ yds.}$$

(7)...   $17\frac{1}{2}$ miles × 12 yds. × $5\frac{1}{2}$ ft. = 677600 cu. yds

677600 cu. yds. at $4\frac{1}{2}d$. per cu. yd. = £12705

(8)...

$$\text{Area of ellipse} = 25 \text{ ft.} \times 18 \text{ ft.} \times \cdot 7854$$
$$= 450 \text{ sq. ft.} \times \cdot 7854$$
$$= 353 \cdot 43 \text{ sq. ft.}$$

(9)...   Horizontal section of column = $(16)^2 \times \cdot 7854$  [in.]

$$= 256 \text{ sq. in.} \times \cdot 7854$$
$$= 201 \cdot 0624 \text{ sq. in.}$$

Solidity of column = $201 \cdot 0624$ sq. in. × 164 in.

$$= 32974 \cdot 2336 \text{ cu. in.}$$
$$= 19 \cdot 0823 \text{ cu. ft.}$$

ft.  in.  ft.  in.  ft.  in.  ft.  in.    ft.  in.
(10)... 7   8+7   8+6  10+5   9 = 27  11
                                      3   6
                                    ‾‾‾‾‾‾‾‾
                                    83   9
                                    13  11   6
                                    ‾‾‾‾‾‾‾‾‾‾
                                    97   8   6
                                             3
                                    ‾‾‾‾‾‾‾‾‾‾
                                   293   1   6 = 293⅛ sq. ft.

293⅛ sq. ft. at 1s. 9d. per ft. = £17 1s. 11¾d.


## EXERCISE XXII.

                              ft.  in.
(1)...            43¾ yds. = 131   3
23 ft. 6 in. + 20 ft. 10 in. =  44   4
                           ‾‾‾‾‾‾‾‾‾‾
                             5775   0
                             ·43   9
                           ‾‾‾‾‾‾‾‾‾‾
                          2)5818   9
                           ‾‾‾‾‾‾‾‾‾‾
                          9)2909   4   6
                           ‾‾‾‾‾‾‾‾‾‾‾‾‾
                            323 sq. yds. 2 sq. ft. 54 sq. in.

(2)...

                                        *5 ft. 3 in.*
       ft.  in.  ft.  in.  sq. ft.  sq. in.
        5   3×4   5 = 23   27
        4   6×3   8 = 16   72
      Area of frame =  6   99
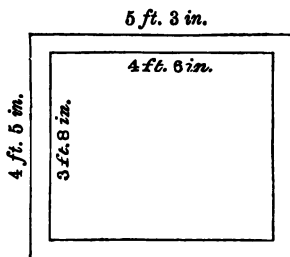


(3)... Area of window = 7½ ft. × 4½ ft. = 90 in. × 54 in.
                                       = 4860 sq. in.

       Area of each quarry = ½(6 × 4½) = 13½ sq. in.

       No. of quarries required, 4860 ÷ 13½ = 360

(4)...       Area of circle $= (8\cdot5)^2 = 72\cdot25$ sq. ft.

        Radius of circle $= \sqrt{72\cdot25 \div 3\cdot1416}$

                $= \sqrt{22\cdot99783549}$

                $= 4\cdot7956$ ft.

(5)...     Area of floor, $27\frac{1}{2}$ ft. $\times 21$ ft. $= 577\frac{1}{2}$ sq. ft.

    Area of 1 yd. matting, 3 ft. $\times 2\frac{5}{8}$ ft. $= 7\frac{7}{8}$ sq. ft.

    Matting required, $577\frac{1}{2} \div 7\frac{7}{8} = 73\frac{1}{3}$ yds.

    $73\frac{1}{3}$ yds. at $1s.\ 3d.$ per yd. $= £4\ 11s.\ 8d.$

(6)...

|  | ft. | in. |  |
|---|---|---|---|
|  | 6 | 3 |  |
|  | 2 | 9 |  |
|  | 12 | 6 |  |
|  | 4 | 8 | 3 |
|  | 17 | 2 | 3 |
|  | 1 | 8 |  |
|  | 17 | 2 | 3 |
|  | 11 | 5 | 6 |
|  | 28 | 7 | 9 |

$= 28$ cu. ft. 1116 cu. in.

(7)...
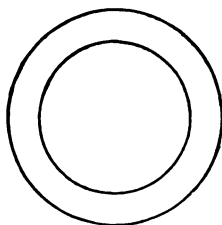


    Area of walk $= (26+18) \times (26-18) \times \cdot7854$

            $= 44$ ft. $\times 8$ ft. $\times \cdot7854$

            $= 276\cdot4608$ sq. ft.

(8)...      Area of field $=$ 48400 sq. yds.

Side of field $= \sqrt{48400}$

$=$ 220 yds.

Perimeter of field $=$ 220 yds. $\times 4 =$ 880 yds.

880 yds. at 2s. 9d. per yd. $=$ £121

(9)...
$$\overset{\text{sq. yds.}}{4840} \;:\; \overset{\text{yds. yds.}}{220 \times 135} \;::\; \overset{s.}{13} \quad \overset{d.}{9} \;:\; x$$

$$\begin{array}{r} 13 \\ 12 \\ \hline 165 \end{array}$$

$$x = \frac{\overset{}{220} \times 135 \times \overset{15}{165}}{\underset{\underset{2}{22}}{4840}} = 1012\tfrac{1}{2}d. = £4 \ 4s. \ 4\tfrac{1}{2}d.$$

(10)...

Area of table$=$5 ft. 6 in. $\times$ 21 in.$=$66 in. $\times$ 21 in.$=$1386 sq. in.

$$\overset{\text{in.}}{\text{Area of each circular hole}=(10\tfrac{1}{2})^2 \times \cdot 7854 = 86 \cdot 59035 \text{ sq. in.}}$$

Remainder, $\overset{\text{sq. in.}}{1386} - (\overset{\text{sq. in.}}{86 \cdot 59035} \times 2) = 1212 \cdot 8193$ sq. in.

$= 8 \cdot 42235625$ sq. ft.

## EXERCISE XXIII.

(1)...      Side of square $= \sqrt{80 \times 45}$

$= \sqrt{3600}$

$=$ 60 ft.

(2)...   22 ft. 8 in. = 272 in.        17 ft. = 204 in.

Hypotenuse of triangle $= \sqrt{272^2 + 204^2}$

$$= \sqrt{73984 + 41616}$$

$$= \sqrt{115600}$$

$$= 340 \text{ in.} = 28 \text{ ft. 4 in.}$$

(3)...   36 ft. 6 in. = 438 in.        27 ft. 6 in. = 330 in.

Base of triangle $= \sqrt{438^2 - 330^2}$

$$= \sqrt{191844 - 108900}$$

$$= \sqrt{82944}$$

$$= 288 \text{ in.} = 24 \text{ ft.}$$

(4)...Perpendicular of triangle $= \sqrt{(67\cdot85)^2 - (40\cdot71)^2}$

$$= \sqrt{4603\cdot6225 - 1657\cdot3041}$$

$$= \sqrt{2946\cdot3184}$$

$$= 54\cdot28 \text{ ft.}$$

(5)...Perpendicular of triangle $= \sqrt{(4\cdot25)^2 - (2\cdot55)^2}$

$$= \sqrt{18\cdot0625 - 6\cdot5025}$$

$$= \sqrt{11\cdot56}$$

$$= 3\cdot4 \text{ chains}$$

Area of triangle $= \frac{1}{2}(3\cdot4 \times 2\cdot55)$

$$= \frac{1}{2}(8\cdot67)$$

$$= 4\cdot335 \text{ sq. chains}$$

$$= 1 \text{ rood } 29\cdot36 \text{ poles}$$

(6)...
$$50$$
$$72$$
$$88$$
$$2)\overline{210}$$
$$\overline{105}$$

$$105 - 50 = 55$$
$$105 - 72 = 33$$
$$105 - 88 = 17$$

$$105 \times 55 \times 33 \times 17 = 3239775$$

Area of triangle $= \sqrt{3239775} = 1799\cdot937498$ sq. ft.

Side of square $= \sqrt{1799\cdot937498}$
$$= 42\cdot425 \text{ ft.}$$

(7)...
$$2)\overline{126}$$
$$\overline{63}$$

$$63 - 42 = 21$$

$$63 \times 21 \times 21 \times 21 = 583443$$

Area of triangle $= \sqrt{583443} = 763\cdot8344$ sq. ft.

(8)... Area of ellipse $= 18\cdot5$ ft. $\times 12\cdot5$ ft. $\times \cdot7854$
$$= 177\cdot991275 \text{ sq. ft.}$$

(9)... Area of quadrant $= \frac{1}{4}\{(10\cdot5)^2 \times 3\cdot1416\}$
$$= \frac{1}{4}(346\cdot3614)$$
$$= 86\cdot59035 \text{ sq. ft.}$$
$$= 86 \text{ sq. ft. } 85 \text{ sq. in.}$$

$$\vdots$$

(10)...Area of mouth of shaft, $5^2 \times \cdot7854 = 19\cdot635$ sq. ft.

$19\cdot635$ sq. ft. $\times 180$ ft. $= 3534\cdot3$ cu. ft.

## EXERCISE XXIV.

(1)...    Area of walls = 23 yds. 2 ft. 6 in. × 9 ft. 9 in.

$= 71\frac{1}{2}$ ft. × $9\frac{3}{4}$ ft.

$= 697\frac{1}{8}$ sq. ft.

Area of 1 yd. paper = 3 ft. × 22 in. = 3 ft. × $1\frac{5}{6}$ ft. = $5\frac{1}{2}$ sq. ft.

Paper required, $697\frac{1}{8} \div 5\frac{1}{2} = 126\frac{3}{4}$ yds.

(2)...         $7\frac{1}{2}$ acres = 36300 sq. yds.

Length of side of field = $\sqrt{36300}$ = 190·525 yds.

(3)...See Euclid, Book I. Prop. xxxii. Cor. 1.

7 angles of heptagon + 4 rt. angles = 14 rt. angles

7 angles of heptagon = 10 rt. angles

Each angle of heptagon = $\frac{10}{7}$ of a rt. angle

$= \frac{10}{7}$ of 90°

$= 128\frac{4}{7}$°

(4)...    $\overset{\text{in.}}{33} \div \overset{\text{in.}}{2\frac{3}{4}} = 12$, diameters in length of plate

$27\frac{1}{2} \div 2\frac{3}{4} = 10$, diameters in breadth of plate

No. of circular pieces = 12 × 10 = 120

(5)...6 ft. × $4\frac{1}{2}$ ft. × 3 ft. = 81 cu. ft.    $(4\frac{1}{2}$ ft.$)^3 = 91\frac{1}{8}$ cu. ft.

$$\overset{\text{cu. ft.}}{81} \quad : \quad \overset{\text{cu. ft.}}{91\frac{1}{8}} \quad :: \quad \overset{\text{t.}}{5} \overset{\text{cwt.}}{5} = \overset{\text{cwt.}}{105} \quad : \quad x$$

$$x = \frac{1}{\overset{9}{\cancel{81}}} \times \frac{\overset{9}{\cancel{729}}}{8} \times \frac{105}{1} = \frac{945}{8} \text{ cwt.} = 5 \text{ tons } 18 \text{ cwt. } 14 \text{ lb.}$$

(6)...     Edge of cube $= \sqrt[3]{421\cdot875} = 7\cdot5$ ft.

Area of each side $= (7\cdot5)^2 = 56\cdot25 = 56\frac{1}{4}$ sq. ft.

(7)...Area of circle $= (16)^2 \times 3\cdot1416 = 804\cdot2496$ sq. in.

$360°$ : $27°$ :: $804\cdot2496$ : $60\cdot31872$, area of sector

(8)...



124 ft.

108 ft.

100 ft.

84 ft.
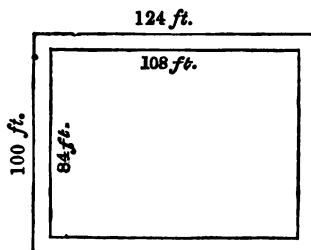
ft.     ft.     sq. ft.
124 × 100 = 12400
108 × 84 = 9072
9)3328
Area of walk = 369 sq. yds. 7 sq. ft.

(9)...Diameter of circle $= 11\frac{1}{2}$ inches

The diameter of the circle is equal to a side of the square.

Area of square $= 11\frac{1}{2} \times 11\frac{1}{2} = 132\frac{1}{4}$ sq. in.
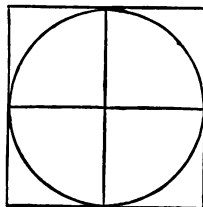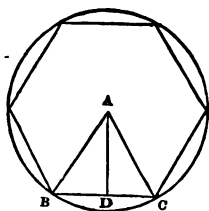
(10)...The hexagon consists of six equi-
lateral triangles, the side of each
measuring $4\frac{1}{2}$ feet

Area of each triangle $=$ BD . AD

$$= 2\cdot25 \times \sqrt{(4\cdot5)^2-(2\cdot25)^2}$$
$$= 2\cdot25 \times \sqrt{15\cdot1875}$$
$$= 2\cdot25 \times 3\cdot8971$$
$$= 8\cdot768475 \text{ sq. ft.}$$

$8\cdot768475 \times 6 = 52\cdot61085$ sq. ft., area of hexagon

## EXERCISE XXV.

(1)...Length of wall $= (65$ yds. $+ 42$ yds.$) \times 2 = 214$ yds.

$$8 \text{ ft. } 9 \text{ in.} = 2\frac{11}{12} \text{ yds.}$$

Surface of wall $= 214$ yds. $\times 2\frac{11}{12}$ yds. $= 624\frac{1}{6}$ sq. yds.

(2)...   3 cu. yds. 4 cu. ft. 1224 cu. in. $= 148104$ cu. in.

3 ft. 8 in. $\times$ 2 ft. 10 in. $= 44$ in. $\times 34$ in. $= 1496$ sq. in.

148104 cu. in. $\div$ 1496 sq. in. $= 99$ in. $= 8$ ft. 3 in., length
of stone

(3)...

|  | ft. in. |  | ft. in. |
|---|---|---|---|
|  | $(2 \quad 8)^3$ | : | $(3 \quad 8)^3$ |
|  | $32^3$ | : | $44^3$ |
|  | $\cancel{32} \times \cancel{32} \times \cancel{32}$ | : | $\cancel{44} \times \cancel{44} \times \cancel{44}$ |
|  | $8 \times 8 \times 8$ | : | $11 \times 11 \times 11$ |
|  | $512$ | : | $1331$ |

(4)...Perimeter of room = (26 ft. 3 in. + 18 ft. 9 in.) × 2 = 90 ft.

Surface of walls = 90 ft. × 10½ ft. = 945 sq. ft.

Length of paper used, 12 yds. × 14 = 168 yds.ʹ = 504 ft.

Width of paper, 945 sq. ft. ÷ 504 ft. = 1⅞ ft. = 22½ in.


(5)... Area of floor = 79⅙ yds. × 2 ft. 4½ in. = 237½ ft. × 2⅜ ft. = 564$\frac{1}{16}$ sq. ft.

$$= 564 \cdot 0625 \text{ sq. ft.}$$

Side of room = $\sqrt{564 \cdot 0625}$ = 23·75 ft. = 23 ft. 9 in.


(6)...

| | |
|---|---|
| 160 | 300 − 160 = 140 |
| 190 | 300 − 190 = 110 |
| 250 | 300 − 250 = 50 |
| 2)600 | |
| 300 | |

$$300 \times 140 \times 110 \times 50 = 231000000$$

Area = $\sqrt{231000000}$ = 15198 sq. yds. = 3 acres 678 sq. yds.

sq. yds.    sq. yds.     s.   d.    d.
4840   :   15198   ::   12   6 = 150   :   x

$$x = \frac{15198 \times 150}{4840} = 471\tfrac{3}{242}d. = £1 \ 19s. \ 3\tfrac{3}{242}d.$$


(7)... Area of table = (4¼ ft.)² × ·7854 = 14·1862875 sq. ft.


(8)...Circumference of circle = 6¼ ft. × 2 × 3·1416 = 39·27 ft.

360°   :   22° 30′   ::   39·27 ft.   :   2·454375, length of arc.

(9)...
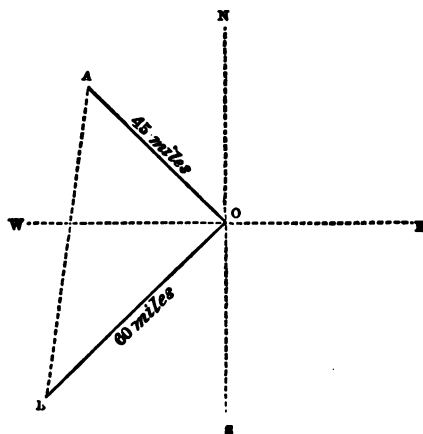


$$OA = 7\tfrac{1}{2} \text{ mi.} \times 6 = 45 \text{ miles}$$
$$OB = 10 \text{ mi.} \times 6 = 60 \text{ miles}$$
$$AB^2 = OA^2 + OB^2$$
$$= 45^2 + 60^2$$
$$= 2025 + 3600$$
$$= 5625$$
$$\therefore AB = 75 \text{ miles}$$

(10)...          Let $x$ feet = a side of the square
Then $(x+3)$ = a side of the enlarged square
$$\text{Now } (x+3)^2 - x^2 = 81$$
$$x^2 + 6x + 9 - x^2 = 81$$
$$6x + 9 = 81$$
$$6x = 72$$
$$x = 12 \text{ feet, side of square}$$

## EXERCISE XXVI.

(1)...Capacity of cistern $= 2\tfrac{7}{8} \text{ ft.} \times 4\tfrac{1}{3} \text{ ft.} \times 2\tfrac{2}{3} \text{ ft.} = 33\tfrac{2}{3} \text{ cu. ft.}$
Weight of water $= 62\tfrac{1}{2} \text{ lb.} \times 33\tfrac{2}{3} = 2076\tfrac{7}{12} \text{ lb.}$

(2)...    $85^2 \times 5 = 36125$ sq. yds.

$\sqrt{36125} = 190{\cdot}0657$ yds.

(3)...    $40$ in. $\times 2\frac{1}{4}$ in. $\times 1\frac{1}{2}$ in. $= 135$ cu. in.

$4\frac{2}{5}$ oz. $\times 135 = 594$ oz. $= 37$ lb. 2 oz.

(4)...    $\frac{5}{8}$ of a mile $= 1100$ yds.

radius of circle $= 1100 \div 6{\cdot}2832 = 175{\cdot}07$ yds.

(5)...    Hypotenuse of triangle $= \sqrt{33^2 + 56^2}$

$= \sqrt{1089 + +3136}$

$= \sqrt{4225}$

$= 65$ yds.

. (6)...BD, the diameter of the circle

$= \sqrt{AB^2 + AD^2}$

$= \sqrt{2.AB^2}$

$= \sqrt{2 \times (19\frac{3}{4})^2}$

$= \sqrt{390{\cdot}0625 \times 2}$

$= \sqrt{780{\cdot}125}$

$= \sqrt{27{\cdot}9307}$ ft.
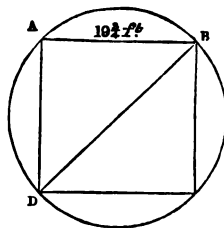


(7)...Contents of each step $= 7\frac{1}{2}$ ft. $\times 1\frac{1}{4}$ ft. $\times \frac{3}{4}$ ft. $= 6\frac{9}{16}$ cu. ft.

Contents of flight $= 6\frac{9}{16}$ cu. ft. $\times 14 = 91\frac{7}{8}$ cu. ft.

$= 91$ cu. ft. 1512 cu. in.

(8)...    $7\frac{1}{2}$ miles $= 39600$ ft.

Circumference of wheel $= 39600$ ft. $\div 2640 = 15$ ft.

Diameter $= 15$ ft. $\div 3{\cdot}1416 = 4{\cdot}7746$ ft.

F F

(9)...Perimeter of room $= (25\frac{1}{2}$ ft. $+ 17\frac{1}{4}$ ft.$) \times 2 = 85\frac{1}{2}$ ft.

Area of walls $= 85\frac{1}{2}$ ft. $\times 10\frac{2}{3}$ ft. $= 912$ sq. ft. $= 101\frac{1}{3}$ sq. yds.

Area of ceiling $= 25\frac{1}{4}$ ft. $\times 17\frac{1}{4}$ ft. $= 439\frac{7}{8}$ sq. ft. $= 48\frac{7}{8}$ sq. yds.

$$
\begin{array}{lccc}
 & \pounds & s. & d. \\
101\frac{1}{3} \text{ sq. yds. at } 10\frac{1}{2}d. \text{ per yd.} = & 4 & 8 & 8 \\
48\frac{7}{8} \text{ sq. yds. at } 16d. \text{ per yd.}.... = & 3 & 5 & 2 \\
\cline{2-4}
 & \pounds 7 & 13 & 10
\end{array}
$$

(10)...See Euclid, Book I. Prop. xxxii. Cor. 1.

8 angles of octagon $+4$ rt. angles $= 16$ rt. angles

8 angles of octagon $= 12$ rt. angles

Each angle of octagon $= \frac{3}{2}$ rt. angles

$= \frac{3}{2}$ of $90°$

$= 135°$

## EXERCISE XXVII.

(1)...

$$
\begin{array}{rcc}
\text{ft.} & \text{in.} & \\
9 & 9 & \\
4 & 2 & \\
\hline
39 & 0 & \\
1 & 7 & 6 \\
\hline
\end{array}
$$

Area of table $= 40\ \ 7\ \ 6 = 40\frac{5}{8}$ sq. ft.

Cost, $40\frac{5}{8}$ sq. ft. at $1s.$ $8d.$ per ft. $= \pounds 3$ $7s.$ $8\frac{1}{2}d.$

(2)...

$$
\begin{array}{r}
\text{ft.} \\
135 \\
47{\cdot}55 + 32{\cdot}85 = 80{\cdot}4 \\
\hline
540 \\
1080\phantom{0} \\
\hline
2)10854{\cdot}0 \\
\hline
9)\ 5427 \text{ sq. ft.} \\
\hline
\end{array}
$$

Area of trapezium $=$  603 sq. yds.

(3)...      Base of triangle $= \sqrt{61^2 - 60^2}$

$$= \sqrt{3721 - 3600}$$

$$= \sqrt{121}$$

$$= 11 \text{ feet}$$

(4)...Length of rectangle $= 1691\frac{1}{4}$ sq. ft. $\div 33$ ft. $= 51\frac{1}{4}$ ft.

(5)...  Top and bottom, $5\frac{1}{2}$ ft. $\times 3\frac{3}{4}$ ft. $\times 2 = 39\frac{3}{8}$ sq. ft.
Two sides,          $5\frac{1}{4}$ ft. $\times 3\frac{1}{4}$ ft. $\times 2 = 34\frac{1}{8}$ sq. ft.
Two ends,           $3\frac{3}{4}$ ft. $\times 3\frac{1}{4}$ ft. $\times 2 = 24\frac{3}{8}$ sq. ft.
Board required $= \overline{97\frac{7}{8}}$ sq. ft.

(6)...Contents of stack, 30 ft. $\times$ 18 ft. $\times$ 10 ft.$=5400$ cu. ft.

$$=9331200 \text{ cu. in.}$$

Contents of each brick, 9 in. $\times 4\frac{1}{2}$ in. $\times 3$ in. $= 121\frac{1}{2}$ cu. in.

No. of bricks, $9331200 \div 121\frac{1}{2} = 76800$

(7)...      34 cu. ft. 567 cu. in. $= 59319$ cu. in.

Edge of cube $= \sqrt[3]{59319} = 39$ in. $= 3$ ft. 3 in.

```
              ft.  in.
               3   3
               3   3
               9   9
                   9   9
Area of each side, 10   6   9
                           6
Area of 6 sides, 63   4   6  = 63 sq. ft. 54 sq. in.
```
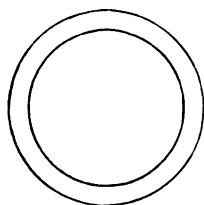
(8)...Area of outer circle $= 25^2 \times \cdot7854$.
Area of inner circle $= 20^2 \times \cdot7854$

Area of walk $= (25^2 - 20^2) \times \cdot7854$
$= 225 \times \cdot7854$
$= 176 \cdot 715$ sq. ft.
$= 19 \cdot 635$ sq. yds.

                  yds.     ft.
(9)...Diameter of tower *and* moat $= 28 + (14 \times 2) = 112$ ft.

Area of moat $= (112 + 84) \times (112 - 84) \times \cdot7854$
$= 196 \times 28 \times \cdot7854$
$= 4310 \cdot 2752$ sq. ft.
$= 478 \cdot 9194$ sq. yds.

(10)...     $9\frac{1}{3}$ ft. $\times 6\frac{1}{2} \times 2\frac{1}{4}$ ft. $= 136\frac{1}{2}$ cubic feet

### EXERCISE XXVIII.

(1)... 3 angles of triangle $= 180°$
$$\begin{array}{r} 43 \cdot 44° \\ \hline 2)\overline{136 \cdot 56°} \end{array}$$
Each equal angle contains $\overline{68 \cdot 28°} = 68° \; 16' \; 48''$
$$\begin{array}{r} 60 \\ \hline 16 \cdot 80' \\ 60 \\ \hline 48 \cdot 00'' \end{array}$$

(2)... 5 angles of pentagon $= 6$ rt. angles $= 540°$
$$5 + 7 + 8 + 11 + 14 = 45$$

| | | | | | |
|---|---|---|---|---|---|
| 45 | : | 5 | :: | 540° | : | 60° |
| 45 | : | 7 | :: | 540° | : | 84° |
| 45 | : | 8 | :: | 540° | : | 96° |
| 45 | : | 11 | :: | 540° | : | 132° |
| 45 | : | 14 | :: | 540° | : | 168° |

$$
\begin{array}{ccccc}
& \text{ft.} & \text{in.} & \text{ft.} & \text{in.} & \text{ft.} & ' & '' \\
(3)... & 5 & 9\frac{1}{2} + 4 & 10\frac{3}{4} & = & 10 & 8 & 3 \\
& & & & & 3 & 8 \\
\hline
& & & & & 32 & 0 & 9 \\
& & & & & 7 & 1 & 6 \\
\hline
& & & & 2)39 & 2 & 3 \\
\hline
& & & & 19' & 7' & 1\frac{1}{2}'' & = 19 \text{ sq. ft. } 85\frac{1}{2} \text{ sq. in}
\end{array}
$$

(4)...Area of field 38 ac. 2 ro. 38 po. $10\frac{1}{2}$ sq. yds. = 187500 sq. yds.

Width of field = 187500 sq. yds. ÷ 500 yds. = 375 yds.

Length of diagonal path = $\sqrt{500^2 + 375^2}$

$= \sqrt{250000 + 140625}$

$= \sqrt{390625}$

$= 625$ yds.

(5)...Area of platform $43\frac{1}{2}$ yds. × 14 yds. = 609 sq. yds.
$= 5481$ sq. ft.

Area of each plank = $14\frac{1}{2}$ ft. × $\frac{7}{8}$ ft. = $12\frac{11}{16}$ sq. ft

No. of planks required, $5481 \div 12\frac{11}{16} = 432$

Cost, 5481 sq. ft. at $8\frac{1}{2}d.$ per ft. = £194 2s. $4\frac{1}{2}d.$

(6)... $22\frac{1}{2}$ ft. × $19\frac{1}{2}$ ft. = $438\frac{3}{4}$ sq. ft. = $48\frac{3}{4}$ sq. yds.

$48\frac{3}{4}$ sq. yds. − 30 sq. yds. = $18\frac{3}{4}$ sq. yds.

$18\frac{3}{4}$ sq. yds. of matting at 15d. per yd. = £1 3s. $5\frac{1}{4}d.$

(7)... £93 10s. ÷ 4s. 6d. = $415\frac{5}{9}$ sq. yds. = 3740 sq. ft.

Height of triangle = $\overset{\text{sq. ft.}}{(3740} \div \overset{\text{ft.}}{136)} \times 2 = \overset{\text{ft.}}{27\frac{1}{2}} \times 2 = 55$ ft.

$$\underset{\text{ft. in. ft. in. ft. in.}}{(8)\ldots\ \ 6\ \ 3\times4\ \ 3\times2\ \ 10}\ =\ \underset{\text{in. in. in.}}{75\times51\times34}\ =\ \underset{\text{cu. in.}}{130050}$$

Capacity of cistern, $130050 \div 277.274 = 469.0306$ **gallons**

$$(9)\ldots\text{Diameter of outer circle} = \underset{\text{ft.}}{15} + \underset{\text{ft.}}{(3\times2)} = \underset{\text{ft.}}{21} = 7 \text{ yds.}$$

$$\text{Area of walk} = (7+5)\times(7-5)\times \cdot7854$$
$$= 12\times2\times\cdot7854$$
$$= 18\cdot8496 \text{ sq. yds.}$$
$$= 18 \text{ sq. yds. } 7\cdot6464 \text{ sq. ft.}$$

$$(10)\ldots\quad\text{Circumference of well} = \underset{\text{in.}}{(34)^2}\times\cdot7854$$
$$= 1156\times\cdot7854$$
$$= 907\cdot9224 \text{ sq. in.}$$
$$= 6\cdot305016 \text{ sq. ft.}$$
$$6\cdot305016 \text{ sq. ft.}\times54\cdot5 \text{ ft.} = 343\cdot6234 \text{ cu. ft.}$$

### EXERCISE XXIX.

$$(1)\ldots\qquad \underset{\text{in.}}{25}\ :\ \underset{\text{in.}}{22}\ ::\ \underset{\text{yds.}}{162\tfrac{1}{2}}\ :\ x$$

$$x = \frac{1}{\cancel{25}}\times\frac{\overset{11}{\cancel{22}}}{1}\times\frac{\overset{13}{\cancel{325}}}{\cancel{2}} = 143 \text{ yds.}$$

$(2)\ldots$ 6 ac. 3 ro. 30 po. $22\tfrac{1}{2}$ sq. yds. $= 33600$ sq. yds.

Length of field $= 33600$ sq. yds. $\div 175$ yds. $= 192$ yds.

                    ft.  in.  ft.  in.  in.   in.   sq. in.   sq. yds.
(3)...Area of yard 45  10 × 26   8 = 550 × 320 = 176000 = 135$\frac{55}{81}$

Area of each stone = 10 in. × 8 in. = 80 sq. in.

No. of stones required, 176000 ÷ 80 = 2200

Cost, 135$\frac{55}{81}$ sq. yds. at 2s. 3d. per yd. = £15 5s. 6$\frac{2}{3}$d.


(4)...Area of floor, 8$\frac{3}{4}$ yds. × 6$\frac{1}{2}$ yds. = 56$\frac{7}{8}$ sq. yds. = 511$\frac{7}{8}$ sq. ft.

Cost, 511$\frac{7}{8}$ sq. ft. at 10d. per ft. = £21 6s. 6$\frac{3}{4}$d.


(5)...          365            675 − 365 = 310
                450            675 − 450 = 225
                535            675 − 535 = 140
              2)1350
                675

          675 × 310 × 225 × 140 = 6591375000

     Area of field = $\sqrt{6591375000}$ = 81186 sq. links

                             = 3 roods 9·89 perches


                             ft.
(6)...   Area of semicircle = $\frac{1}{2}\{(21\frac{1}{2})^2 \times 3\cdot1416\}$
                           = $\frac{1}{2}(462\cdot25 \times 3\cdot1416)$
                           = $\frac{1}{2}(1452\cdot2046)$
                           = 726·1023 sq. ft.


(7)...   35 yds. × 22$\frac{1}{2}$ yds. × 35 ft. = 9187$\frac{1}{2}$ cubic yards


                ft.   ft.   ft.   cu. ft.
(8)...Solidity, 14$\frac{1}{2}$ × 1$\frac{5}{8}$ × 1$\frac{1}{4}$ = 33$\frac{11}{48}$ = 33 cu. ft. 396 cu. in.
     Value, 33$\frac{11}{48}$ cu. ft. at 2s. 8d. per ft. = £4 8s. 7$\frac{1}{3}$d.

(9)...  Depth of box $= \sqrt[3]{3\frac{3}{8}} = \sqrt[3]{\frac{27}{8}} = \frac{3}{2}$ ft. $= 18$ in.

(10)...         Area of interior surface $= 1\frac{1}{2}^{\text{ft.}} \times 1\frac{1}{2}^{\text{ft.}} \times 6$

$= 2\frac{1}{4}$ sq. ft. $\times 6$

$= 13\frac{1}{2}$ sq. ft.

*EXERCISE XXX.*

<pre>
              ft.  in.
(1)...         82   6
               56   3
             ─────────
             4620   0
               20   7   6
             ─────────────
           9)4640   7   6
             ─────────────
              515⅚ sq. yds.
</pre>

515⅚ sq. yds. at 3s. 4d. per yd. $= £85$ 18s. 9d.

(2)...  $10\frac{1}{2}^{\text{ft.}} : 11\frac{1}{4}^{\text{ft.}} :: 175 \times 22\frac{1}{2}^{\text{yds. in.}} : x \times 25^{\text{yds. in.}}$

$x = (11\frac{1}{4} \times 175 \times 22\frac{1}{2}) \div (10\frac{1}{2} \times 25)$

$= \frac{45}{4} \times \frac{\overset{7}{\cancel{175}}}{1} \times \frac{\overset{15}{\cancel{45}}}{\cancel{2}} \times \frac{\cancel{2}}{\underset{3}{\cancel{21}}} \times \frac{1}{\cancel{25}}$

$= \frac{675}{4}$ yds. $= 168\frac{3}{4}$ yds.

(3)...     Perpendicular of triangle $= (48\frac{1}{8} \div 8\frac{1}{2}^{\text{ft.}}) \times 2$

$= 5\frac{2}{3}$ ft. $\times 2$

$= 11\frac{1}{3}$ ft. $= 136$ in.

Hypotenuse of triangle $= \sqrt{136^2 + 102^2}$

$= \sqrt{18496 + 10404}$

$= \sqrt{28900}$

$= 170$ in. $= 14$ ft. 2 in.

(4)...          Major axis $= 25 \times 2 = 50$ ft.

           Minor axis $= 18 \times 2 = 36$ ft.

$$\overset{\text{ft.} \quad \text{ft.}}{\text{Area of ellipse} = 50 \times 36 \times \cdot 7854}$$

$$= 1413 \cdot 72 \text{ sq. ft.}$$

$$= 157 \cdot 08 \text{ sq. yds.}$$

(5)...          $\frac{3}{4}$ of an acre $= 3630$ sq. yds.

$$\text{Diameter of circle} = \sqrt{3630 \div \cdot 7854}$$

$$= \sqrt{4621 \cdot 848739}$$

$$= 67 \cdot 984 \text{ yds.}$$

(6)...If 1 represent the side of the larger field, then $\frac{4}{5}$ will represent the side of the smaller field, and $(\frac{4}{5})^2$ or $\frac{16}{25}$ its area.

$$1 + \tfrac{16}{25} = \tfrac{41}{25}$$

10 ac. 3 ro. 36 per. 17 sq. yds. $= 53136$ sq. yds.

$$\overset{\text{sq. yds.}}{\tfrac{41}{25} \quad : \quad 1 \quad :: \quad 53136 \quad : \quad \text{area of larger field}}$$

$$\text{Area} = \frac{25}{41} \times \frac{\overset{1296}{\cancel{53136}}}{1} = 32400 \overset{\text{sq. yds.}}{=} 6 \overset{\text{ac.}}{} 2 \overset{\text{ro.}}{} 31 \overset{\text{per.}}{} 2\tfrac{1}{4}$$

$$\begin{array}{ccccc} & \text{ac.} & \text{ro.} & \text{per.} & \text{sq. yds.} \\ & 10 & 3 & 36 & 17 \\ & 6 & 2 & 31 & 2\tfrac{1}{4} \\ \hline \text{Area of smaller field,} & 4 & 1 & 5 & 14\tfrac{3}{4} \end{array}$$

(7)...     Contents of block, $\overset{\text{ft.}}{4\tfrac{1}{2}} \times \overset{\text{ft.}}{1\tfrac{1}{2}} \times \overset{\text{ft.}}{1\tfrac{1}{4}} = 8\tfrac{7}{16}$ cu. ft.

$$\text{Weight} = \overset{\text{lb.}}{168} \times 8\tfrac{7}{16} = \overset{\text{lb.}}{1417\tfrac{1}{2}} = \overset{\text{cwt. qrs. lb.}}{12 \quad 2 \quad 17\tfrac{1}{2}}$$

$$(8)... \quad \text{Mean width} = \overset{\text{ft.}\quad\text{ft.}}{(34+65)}\div 2 = \overset{\text{ft.}}{49\tfrac{1}{2}} = \overset{\text{yds.}}{16\tfrac{1}{2}}$$

$$\tfrac{5}{8} \text{ of a mile} = 1100 \text{ yds.}$$

$$\text{Earth removed} = \overset{\text{yds.}}{1100} \times \overset{\text{yds.}}{16\tfrac{1}{2}} \times \overset{\text{yds.}}{6} = 108900 \text{ cu. yds.}$$

$$(9)... \quad \text{Base of pyramid} = \overset{\text{ft.}}{4\tfrac{1}{2}} \times \overset{\text{ft.}}{4\tfrac{1}{2}} = \overset{\text{sq. ft.}}{20\tfrac{1}{4}}$$

$$\text{Solidity} = \tfrac{1}{3}(20\tfrac{1}{4} \text{ sq. ft.} \times 12 \text{ ft.})$$

$$= \tfrac{1}{3} \text{ of } 243 \text{ cu. ft.}$$

$$= 81 \text{ cu. ft.}$$

$$(10)...\text{Capacity of box} = \overset{\text{ft.}}{5\tfrac{1}{2}} \times \overset{\text{ft.}}{3\tfrac{1}{2}} \times \overset{\text{ft.}}{2\tfrac{1}{3}} = \overset{\text{in.}}{66} \times \overset{\text{in.}}{42} \times \overset{\text{in.}}{28} = \overset{\text{cu. in.}}{77616}$$

$$\text{Space required for each book } \overset{\text{in.}}{10\tfrac{1}{2}} \times \overset{\text{in.}}{6} \times \overset{\text{in.}}{1\tfrac{3}{4}} = 110\tfrac{1}{4} \text{ cu. in.}$$

$$\text{No. of books} = 77616 \div 110\tfrac{1}{4} = 704$$

*EXERCISE XXXI.*

$$(1)... \quad 17\cdot875 \text{ ft.} = \begin{array}{rrr} \text{ft.} & ' & '' \\ 17 & 10 & 6 \\ 10 & 4 & 6 \\ \hline 178 & 9 & 0 \\ 5 & 11 & 6 \\ & 8 & 11 & 3 \\ \hline 2)185 & 5 & 5 & 3 \\ \hline 92' & 8' & 8'' & 7''' & 6'''' \end{array}$$

$$= 92 \text{ sq. ft. } 104\tfrac{5}{8} \text{ sq. in.}$$

(2)...30 ft. 4 in. = 364 in.  22 ft. 9 in. = 273 in.

Diameter of parallelogram = $\sqrt{364^2 + 273^2}$

$= \sqrt{132496 + 74529}$

$= \sqrt{207025}$

$= 455$ in.

$= 37$ ft. 11 in.

(3)...  Width of field = $\sqrt{1065^2 - 852^2}$

$= \sqrt{1134225 - 725904}$

$= \sqrt{408321}$

$= 639$ links

Area of field = $\overset{\text{li.}}{852} \times \overset{\text{li.}}{639} = 544428$ sq. links

$= 5$ ac. 1 ro. 31·0848 po.

(4)...See figure in *Exercise X.* (7)

Perpendicular of triangle = $\sqrt{(52\frac{1}{2})^2 - 42^2}$

$= \sqrt{2756·25 - 1764}$

$= \sqrt{992·25}$

$= 31·5$ ft.

Area of triangle = $31·5$ ft. $\times 42$ ft.

$= 1323$ sq. ft.

$= 147$ sq. yds.

(5)...  Breadth of street = $\sqrt{62^2 - 48^2}$

$= \sqrt{3844 - 2304}$

$= \sqrt{1540}$

$= 39·2428$ ft.

(6)...    Perimeter of room = $\overset{\text{yds.} \quad \text{yds.}}{(6\frac{1}{4}+4\frac{3}{4})} \times 2 = 22$ yds.

Area of walls = 22 yds. $\times 3\frac{1}{2}$ yds. = 77 sq. yds. = 693 sq. ft.

Area of 1 piece of paper = 3 ft. $\times 1\frac{5}{6}$ ft. $\times 12 = 66$ sq. ft.

Quantity of paper required, $693 \div 66 = 10\frac{1}{2}$ pieces

$10\frac{1}{2}$ pieces at 5s. 6d. per piece = £2 17s. 9d.


(7)...See Euclid, Book I. Proposition xxxii. Cor. 1.

9 angles of nonagon + 4 rt. angles = 18 rt. angles

9 angles of nonagon = 14 rt. angles

Each angle of nonagon = $1\frac{4}{9}$ of a rt. angle

$= 1\frac{4}{9}$ of 90°

$= 140°$


(8)...See Appendix, page 179.

Area of plantation = $375^2 \times \cdot 07958$

$= 140625$ sq. yds. $\times \cdot 07958$

$= 11190 \cdot 9375$ sq. yds.

$= 2$ ac. 1 ro. 9 po. $28\frac{11}{16}$ sq. yds.


(9)...          3 cu. ft. = 5184 cu. in.

15 in. $\times 13\frac{1}{2}$ in. = $202\frac{1}{2}$ sq. in.

Length required, 5184 cu. in. $\div 202\frac{1}{2}$ sq. in. = $25\frac{3}{5}$ in.


(10)...Contents of stone, $6\frac{3}{4}$ ft. $\times 3\frac{1}{8}$ ft. $\times 2\frac{1}{8}$ ft. = $46\frac{5}{16}$ cu. ft.

Weight of stone, 156 lb. $\times 46\frac{5}{16} = 7224\frac{3}{4}$ lb.

$= 3$ tons 4 cwt. 2 qrs. $0\frac{3}{4}$ lb.

## *EXERCISE XXXII.*

(1)...

$$\begin{array}{r} 5\frac{1}{4} \\ 4 \\ 2\frac{3}{4} \\ \hline 2\overline{)12} \\ \hline 6 \end{array}$$

4 in.  9½ in.

5¼ in.

$$6 - 5\frac{1}{4} = \frac{3}{4}, \qquad 6 - 4 = 2, \qquad 6 - 2\frac{3}{4} = 3\frac{1}{4}$$

$$6 \times \frac{3}{4} \times 2 \times 3\frac{1}{4} = 29\frac{1}{4} = 29 \cdot 25$$
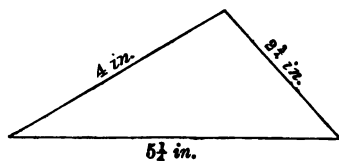
Area of triangle $= \sqrt{29 \cdot 25} = 5 \cdot 4083$ sq. in.

(2)...  Top and bottom, $4\frac{2}{3}$ ft. $\times 2\frac{1}{2}$ ft. $\times 2 = 23\frac{1}{3}$ sq. ft.

Two sides .........$4\frac{2}{3}$ ft. $\times 2\frac{1}{4}$ ft. $\times 2 = 21$ sq. ft.

Two ends......... $2\frac{1}{2}$ ft. $\times 2\frac{1}{4}$ ft. $\times 2 = 11\frac{1}{4}$ sq. ft.

Quantity of tin required............... $55\frac{7}{12}$ sq. ft.

(3)...Cost of fencing each side of larger garden, £1   2s.   6d.

„          „          „    smaller garden,    15s.   9d.

Ratio of sides, $22\frac{1}{2}$   :   $15\frac{3}{4}$

90   :   63

10   :   7

Ratio of areas, 100   :   49

(4)...Surface of each side$=10$ sq. ft. $1\frac{1}{2}$ sq. in.$\div 6 = 240\frac{1}{4}$ sq. in.

Length of edge $= \sqrt{240\frac{1}{4}} = \sqrt{\frac{961}{4}} = \frac{31}{2} = 15\frac{1}{2}$ in.

(5)...Area of each plank, $\overset{\text{yds. in.}}{6\frac{1}{4} \times 10} = 18\frac{3}{4} \times \overset{\text{ft. ft.}}{\frac{5}{6}} = 15\frac{5}{8}$ sq. ft.

Area of 45 planks, $15\frac{5}{8}$ sq. ft. $\times 45 = 703\frac{1}{8}$ sq. ft.

Value, $703\frac{1}{8}$ sq. ft. at 8d. per ft. $=$ £23 8s. 9d.

(6)....  Perimeter of room, $(18\frac{3}{4}+15) \times 2 = 67\frac{1}{2}$ ft.

Area of walls, $67\frac{1}{2}$ ft. $\times 12\frac{3}{4}$ ft. $= 860\frac{5}{8}$ sq. ft.

$860\frac{5}{8}$ sq. ft. $-\frac{1}{6}(860\frac{5}{8}$ sq. ft.$) = 717\frac{3}{16}$ sq. ft.

Area of 1 piece of paper, 3 ft. $\times 1\frac{7}{8}$ft. $\times 12 = 67\frac{1}{2}$ sq. ft.

Paper required, $717\frac{3}{16} \div 67\frac{1}{2} = 10\frac{5}{8}$ pieces

Cost, $10\frac{5}{8}$ pieces at $7s.$ $6d.$ per piece $= £3$ $19s.$ $8\frac{1}{4}d.$


(7)...Capacity of box, $5\frac{1}{2} \times 3\frac{1}{2} \times 2\frac{1}{4} \times 324 = 14033\frac{1}{4}$ cu. in.

$31\frac{1}{2}$ in. $\times 22$ in. $= 693$ sq. in.

Required depth, $14033\frac{1}{4}$ cu. in $\div 693$ sq. in. $= 20\frac{1}{4}$ in.


(8)...See Appendix, page 180

Surface of sphere $= (3\cdot5)^2 \times 3\cdot1416$

$= 12\cdot25$ sq. ft. $\times 3\cdot1416$

$= 38\cdot4846$ sq. ft.


(9)...   Volume of sphere $= (25)^3 \times \cdot5236$

$= 15625$ cu. in. $\times \cdot5236$

$= 8181\cdot25$ cu. in.


(10)...   Diameter of sphere $= \sqrt[3]{33510\cdot4 \div \cdot5236}$

$= \sqrt[3]{64000}$

$= 40$ in.

## EXERCISE XXXIII.

(1)...   Area of floor, $29\frac{1}{4}$ ft. × $23\frac{1}{3}$ ft. = $682\frac{1}{2}$ sq. ft.
Area of 1 yd. carpeting, 3 ft. × $2\frac{1}{3}$ ft. = 7 sq. ft.
Carpeting required, $682\frac{1}{2}$ ÷ 7 = $97\frac{1}{2}$ yds.
Cost, $97\frac{1}{2}$ yds. at 3s. 10d. per yd. = £18 13s. 9d.

(2)...
```
                      ft.   '    "
        7·875 yds. = 23    7    6
                     16   10
                    ─────────────
                    378    0    0
                     19    8    3
                    ─────────────
                  2)397    8    3
                  ─────────────
                  9)198   10    1½
                  ─────────────
                    22 sq. yds. 121⅓ sq. in.
```

(3)...Circumference of wheel, 4 ft. $1\frac{1}{2}$ in. × 3·1416 = 12·9591 ft.
Distance travelled, 12·9591 ft. × 25000 = 107992·5 yds.
$$= 61 \text{ mi. } 632\frac{1}{2} \text{ yds.}$$

(4)...          $27\frac{1}{2}$ ac. = 133100 sq. yds.
Length of diagonal path = $\sqrt{133100 \times 2}$
$$= \sqrt{266200}$$
$$= 515·9457 \text{ yds.}$$

(5)...AC = $\sqrt{(11·625)^2 + (15·5)^2}$
$$= \sqrt{135·140625 + 240·25}$$
$$= \sqrt{375·390625}$$
$$= 19·375 \text{ miles}$$
$$= 19 \text{ miles 3 furlongs}$$
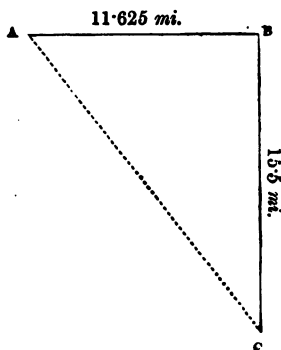
(6)...   Area of yard, £33 16s. ÷ 2s. 3d. = 300$\frac{4}{9}$ sq. yds.

= 2704 sq. ft.

Length of side = $\sqrt{2704}$ = 52 ft.

(7)...Area of grass plot = 20 yds. × 20 yds. = 400 sq. yds.

Area of flower bed = $6^2$ × ·7854 = 28·2744 sq. yds.

400 sq. yds. − 28·2744 sq. yds. = 371·7256 sq. yds.



(8)...AB = 65 yds. + $\overset{\text{ft.}}{(8 \times 2)}$ = $\overset{\text{ft.}}{211}$
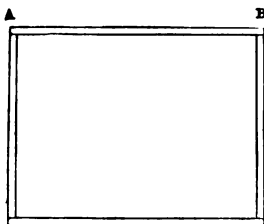
211 ft. × 8 ft. × 2 = 3376 sq. ft.
150 ft. × 8 ft. × 2 = 2400 sq. ft.
Area of paths ... = $\overline{5776}$ sq. ft.

Quantity of gravel required = 5776 sq. ft. × $\frac{1}{6}$ ft.

= 962$\frac{2}{3}$ cu. ft.

= 35 cu. yds. 17$\frac{2}{3}$ cu. ft.

(9)...   Capacity of cistern, $\overset{\text{ft.}}{5\frac{4}{5}} \times \overset{\text{ft.}}{2\frac{5}{8}} \times \overset{\text{ft.}}{3\frac{1}{8}}$ = 50$\frac{15}{32}$ cu. ft.

Weight of water, 1000 oz. × 50$\frac{15}{32}$ = 50468$\frac{3}{4}$ oz.

= 1 ton 8 cwt. 18 lb. 4$\frac{3}{4}$ oz.

(10)...      Edge of cube = $\sqrt[3]{21952}$ = 28 in.

Surface of box = $\overset{\text{in.}}{(28)^2} + 6$

= 784 sq. in. × 6

= 4704 sq. in.

= 32$\frac{2}{3}$ sq. ft.

Cost of painting, 32$\frac{2}{3}$ sq. ft. at 2$\frac{1}{4}$d. per ft. = 6s. 1$\frac{1}{2}$d.

## *EXERCISE XXXIV.*

(1)...   3 angles of triangle = 180°
       Vertical angle =   40·9375ᵃ
                 2)139·0625°
   Each equal angle =   69·53125° = 69° 31′ 52·5″
                       60
                  31·87500′
                       60
                  52·50000″

            ch.     ch.      ch.
(2)...        9·75+11·55 = 21·3
                   14·8
                   1704 ·
                  852
                  213
               2)315·24
          10)157·62 sq. chains
               15·762 ac. = 15 ac. 3 ro. 1·92 po.
                   4
                3·048 ro.
                  40
                1·920 po.

(3)...          8 ch. 45 li. = 8·45 chains
  1 ch. 75 li. + 2 ch. 55 li. =   4·3
                   2535
                   3380
               2)36·335
          10)18·1675 sq. chains
               1·81675 ac. = 1 ac. 3 ro. 10·68 po.
                   4
               3·26700 ro.
                  40
              10·68000 po.

(4)...    Hypotenuse of triangle $= \sqrt{(27\frac{1}{2})^2 + 150^2}$

$= \sqrt{756\cdot25 + 22500}$

$= \sqrt{23256\cdot25}$

$= 152\cdot5$ in.

$= 12$ ft. $8\frac{1}{2}$ in.

(5)...Area of 6 floors, $18\frac{3}{4}$ ft. $\times 14\frac{2}{3}$ ft. $\times 6 = 1650$ sq. ft.

Area of each plank, $12\frac{1}{2}$ ft. $\times 11$ in. $= 11\frac{11}{24}$ sq. ft.

No. of planks required, $1650 \div 11\frac{11}{24} = 144$

Cost, 1650 sq. ft. at 8d. per sq. ft. $= £55$

ft.
(6)...        Area of plot $= (40)^2 \times \cdot7854$

$= 1600$ sq. ft. $\times \cdot7854$

$= 1256\cdot64$ sq. ft.

$= 139\frac{4}{5}$ sq. yds.

Cost, $139\frac{4}{5}$ sq. yds. at $7\frac{1}{2}d.$ per. yd. $= £4$ $7s.$ $3\frac{1}{2}d.$

(7)...        $7\frac{1}{4}$ ft. $\times 3\frac{2}{3}$ ft. $= 26\frac{7}{12}$ sq. ft.

Depth of cistern, 87 cu. ft. $\div 26\frac{7}{12}$ sq. ft. $= 3\frac{3}{11}$ ft.

in.
(8)...        Area of circle $= (20)^2 \times \cdot7854$

$= 400$ sq. in. $\times \cdot7854$

$= 314\cdot16$ sq. in.

Capacity of hamper $= 314\cdot16$ sq. in. $\times 28$ in. $= 8796\cdot48$ c. in.

$= 5$ c. ft. $156\cdot48$ c. in.

(9)...

ft.
$2\frac{1}{2}$
$2$
$1\frac{1}{2}$

$2)\overline{6}$

$\overline{3}$

$3-2\frac{1}{2} = \frac{1}{2}$
$3-2\ \ = 1$
$3-1\frac{1}{2} = 1\frac{1}{2}$

$$3 \times \tfrac{1}{2} \times 1 \times 1\tfrac{1}{2} = 2\tfrac{1}{4}$$

Area of base $= \sqrt{2\tfrac{1}{4}} = \sqrt{\tfrac{9}{4}} = \tfrac{3}{2} = 1\tfrac{1}{2}$ sq. ft.

Solidity of prism $= 1\tfrac{1}{2}$ sq. ft. $\times 8\tfrac{1}{2}$ ft. $= 12\tfrac{3}{4}$ cu. ft.

(10)... Capacity of cart, 80 in. × 54 in. × 24 in.=103680 cu. in.

Contents of each slate, 16 in. × 9 in. × $\frac{3}{16}$ in. = 27 cu. in.

No. of slates, 103680÷27 = 3840

## EXERCISE XXXV.

(1)...See *Exercise* XX. (1)

|  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|
| | 90° | 0′ | 0″ | | 90° | 0′ | 0″ |
| | 44° | 18′ | 32″ | | 63° | 26′ | 38″ |
| Comp. = | 45° | 41′ | 28″ | Comp. = | 26° | 33′ | 22″ |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 180° | 0′ | 0″ | | 180° | 0′ | 0″ |
| | 72° | 25′ | 16″ | | 110° | 46′ | 33″ |
| Supp. = | 107° | 34′ | 44″ | Supp. = | 69° | 13′ | 27″ |

(2)...Area of field = $\overset{\text{yds. yds.}}{136 \times 95}$ = 12920 sq. yds.

= 2 ac. 2 ro. 27 po. $3\frac{1}{4}$ sq. yds.

$\frac{3}{8}$ of an acre =      1 ro. 20 po.

Area of remainder = 2 ac. 1 ro.   7 po $3\frac{1}{4}$ sq. yds.

(3)...        124·5              154·25 − 124·5 = 29·75
              97·5              154·25 −  97·5 = 56·75
              86·5              154·25 −  86·5 = 67·75
         2)308·5
           154·25

$154·25 \times 29·75 \times 56·75 \times 67·75 = 17643604·26171875$

Area of field = $\sqrt{17643604·26171875}$ = 4200·4295 sq. yds.

$$\begin{array}{cccccccc} \text{ft.} & \text{ft.} & & \text{ft.} & \text{ft.} & & \pounds & s. & d. & d. \\ (4)...20\tfrac{1}{4} \times 16\tfrac{1}{2} & : & 27\tfrac{3}{4} \times 21\tfrac{1}{2} & :: & 7 & 8 & 6 = 1782 & : & x \end{array}$$

$$x = (27\tfrac{3}{4} \times 21\tfrac{1}{2} \times 1782) \div (20\tfrac{1}{4} \times 16\tfrac{1}{2})$$

$$= \frac{\cancel{111}^{37}}{\cancel{4}} \times \frac{43}{\cancel{2}} \times \frac{\cancel{1782}^{\cancel{22}^{2}}}{1} \times \frac{\cancel{4}}{\cancel{81}} \times \frac{\cancel{2}}{\cancel{33}_3}$$

$$= 3182d. = \pounds13 \ 5s. \ 2d.$$



7 ft. 6 in.

6 ft. 4 in.

$$\begin{array}{ccccc} \text{ft.} & \text{in.} & \text{in.} & & \text{sq. ft.} \\ (5)... \quad 7 & 6 & \times 13\tfrac{1}{2} & = & 8\tfrac{7}{16} \\ 6 & 4\tfrac{1}{2} & \times 13\tfrac{1}{2} \times 2 & = & 14\tfrac{11}{32} \\ & & & & 22\tfrac{25}{32} \end{array}$$
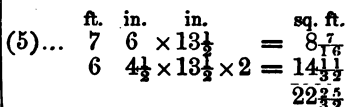
$22\tfrac{25}{32}$ sq. ft. $\times 4 = 91\tfrac{1}{8}$ sq. ft.

(6)...        Area of oval = 125 yds. × 75 yds × ·7854

                            = 9375 sq. yds. × ·7854

                            = 7363·125 sq. yds.

                            = $7363\tfrac{1}{8}$ sq. yds.

(7)... 8 ft. × $4\tfrac{1}{2}$ ft. × $3\tfrac{1}{4}$ ft. = 117 cu. ft. = 202176 cu. in.

Capacity of cistern, 202176 ÷ 277·274 = 729·1559 gallons.

(8)...See Appendix, page 180.

$$\text{Area of mound} = \tfrac{1}{2}(20^2 \times 3\cdot1416)$$
$$= \tfrac{1}{2}(400 \times 3\cdot1416)$$
$$= \tfrac{1}{2}(1256\cdot64)$$
$$= 628\cdot32 \text{ sq. ft.}$$

(9)...

$$\text{Silk required} = 25^2 \times 3\cdot1416$$
$$= 625 \text{ sq. ft.} \times 3\cdot1416$$
$$= 1963\cdot5 \text{ sq. ft.}$$
$$= 218\tfrac{1}{6} \text{ sq. yds.}$$
$$\text{Gas required} = 25^3 \times \cdot5236$$
$$= 15625 \text{ cu. ft.} \times \cdot5236$$
$$= 8181\tfrac{1}{4} \text{ cu. ft.}$$

(10)...

$$\text{Area of mouth of well} = \overset{\text{ft.}}{(3\tfrac{1}{2})^2} \times \cdot7854$$
$$= 12\cdot25 \text{ sq. ft.} \times \cdot7854$$
$$= 9\cdot62115 \text{ sq. ft.}$$

$$9\cdot62115 \text{ sq. ft.} \times 180 \text{ ft.} = 1731\cdot807 \text{ cu. ft.}$$

## EXERCISE XXXVI.

(1)...
$$55 \text{ yds.} \times 34 \text{ yds.} = 1870 \text{ sq. yds.}$$
$$(55+18) \times (34+15) = 73 \text{ yds.} \times 49 \text{ yds.} = 3577 \text{ sq. yds.}$$
$$3577 \text{ sq. yds.} - 1870 \text{ sq. yds.} = 1707 \text{ sq. yds.}$$

(2)...    Slant height of roof

$$= \sqrt{5^2 + (3\cdot75)^2}$$
$$= \sqrt{25 + 14\cdot0625}$$
$$= \sqrt{39\cdot0625}$$
$$= 6\cdot25 = 6\tfrac{1}{4} \text{ yds.}$$
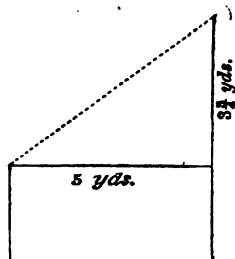
Area of roof = 12 yds. × $6\tfrac{1}{4}$ yds. = 75 sq. yds.

(3)...        Let $5x$ = length of room, in feet

then $4x$ = breadth   „        „

and $2x$ = height    „        „

$$5x \times 4x \times 2x = 40x^3 = 5000$$

$$\therefore x^3 = 125$$

and $x = 5$

Hence, length of room = $5x$ = 25 feet

breadth   „    = $4x$ = 20  „

height   „    = $2x$ = 10  „

Area of floor = 25 ft. × 20 ft. = 500 sq. ft.

Cost of carpet, 500 sq. ft. at 4s. 6d. per sq. yd. = £12 10s.

ft.   ft.

(4)...  Perimeter of room = $(25 + 20) \times 2$ = 90 ft.

Area of walls, 90 ft. × 10 ft. = 900 sq. ft. = 100 sq. yds.

Area of 1 piece of paper = 3 ft. × $2\tfrac{1}{4}$ ft. × 12 = 81 sq. ft.

= 9 sq. yds.

Paper required, 100 ÷ 9 = $11\tfrac{1}{9}$ pieces

Cost, $11\tfrac{1}{9}$ pieces at 6s. 6d. per piece = £3 12s. $2\tfrac{2}{3}d.$

(5)...    Mean width of ditch = $\frac{1}{2}(3\frac{1}{2}\overset{\text{ft.}}{+}2\frac{1}{2}\overset{\text{ft.}}{)}$ = 3 ft.

2160 ft. × 3 ft. × 2 ft. = 12960 cu. ft. = 480 cu. yds.

Each labourer digs 8 cu. yds. × 6 = 48 cu. yds. in the week

No. of labourers required, 480÷48 = 10

(6)...    10 angles of decagon + 4 rt. angles = 20 rt. angles

10 angles of decagon = 16 rt. angles

Each angle of decagon = $\frac{8}{5}$ of a rt. angle

= $\frac{8}{5}$ of 90°

= 144°

(7)...    Area of grass plot = 20 yds. × 15 yds. = 300 sq. yds.

Area of flower-bed = 16 ft. × 12 ft. × ·7854

= 192 sq. ft. × ·7854

= 150·7968 sq. ft.

= 16·7552 sq. yds.

300 sq. yds. − 16·7552 sq. yds. = 283·2448 sq. yds.

(8)...    Area of walk = $(20\frac{1}{2}\overset{\text{ft.}}{+}13\frac{1}{2}\overset{\text{ft.}}{)} \times (20\frac{1}{2}\overset{\text{ft.}}{-}13\frac{1}{2}\overset{\text{ft.}}{)} \times$ ·7854

= 34 ft. × 7 ft. × ·7854

= 238 sq. ft. × ·7854

= 186·9252 sq. ft.

(9)...    Section of pillar = $(3\frac{1}{5})^{2}\overset{\text{ft.}}{\times}$ ·07958

= 9·765625 sq. ft. × ·07958

= ·7771484375 sq. ft.

Contents of pillar = ·7771484375 sq. ft. × 16 ft.

= 12·434375 cu. ft.

= 12 cu. ft. 750$\frac{3}{5}$ cu. in.

(10)...          Contents of ball $= 2^3 \times \cdot 5236$

$= 4 \cdot 1888$ cu. in.

| cu. in. | | cu. in. | | oz. | | oz. |
|---|---|---|---|---|---|---|
| 1728 | : | 4·1888 | :: | 1825 | : | 4·4239, weight of ball |

## EXERCISE XXXVII.

(1)...      24 ac. 26 per. $17\frac{1}{2}$ sq. yds. $= 116964$ sq. yds.

Length of side of field $= \sqrt{116964} = 342$ yds.

(2)...

```
      ft.   '   "
      19    8   6
      13    7  10
     ───────────
     256    2   6
      11    5  11   6
       1    4   5   1
     ───────────────
     269 ft. 0' 10" 7"'  = 269 sq. ft. 10 7/13 sq. in.
```

(3)...      $2\frac{1}{4}$ miles $= 4840$ yds.      $1\frac{3}{4}$ mile $= 3080$ yds.

No. of acres $= \dfrac{\cancel{4840} \times 3080}{\cancel{4840}} = 3080$

(4)...          $BD = \sqrt{AB^2 - AD^2}$

$= \sqrt{85^2 - 84^2}$

$= \sqrt{7225 - 7056}$

$= \sqrt{169}$

$= 13$ yds.

Area of triangle $= 84$ yds. $\times 13$ yds. $= 1092$ sq. yds.

(5)...      Superficies of cube $= (13\frac{1}{2})^2 \times 6$

$= 182\frac{1}{4}$ sq. in. $\times 6$

$= 1093\frac{1}{2}$ sq. in.

$= 7$ sq. ft. $85\frac{1}{2}$ sq. in.

(6)...     Area of ground $= 125\frac{1}{2}$ ft. $\times 109\frac{1}{2}$ ft.

$$= 13742\frac{1}{4} \text{ sq. ft.}$$

$$= 1526\frac{11}{12} \text{ sq. yds.}$$

sq. yds.    sq. yd.    £   s.   d.   s.
$1526\frac{11}{12}$   :   1   ::   229   0   9 $=4580\frac{3}{4}$   :   cost per sq. yd.

$$\text{Cost per sq. yd.} = \frac{\cancel{12}}{\cancel{18373}} \times \frac{\overset{3}{\cancel{18373}}}{\cancel{4}} = 3 \text{ shillings}$$

(7)...
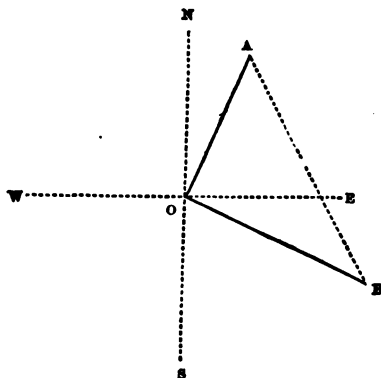


$$OA = 8\frac{1}{4} \text{ mi.} \times 20 = 165 \text{ mi.}$$

$$OB = 11 \text{ mi.} \times 20 = 220 \text{ mi.}$$

$$AB = \sqrt{OA^2 + OB^2}$$

$$= \sqrt{165^2 + 220^2}$$

$$= \sqrt{27225 + 48400}$$

$$= \sqrt{75625}$$

$$= 275 \text{ miles}$$

$$\overset{\text{ft.}}{\phantom{x}}\quad\overset{\text{ft.}}{\phantom{x}}\quad\overset{\text{ft.}}{\phantom{x}}\quad\overset{\text{ft.}}{\phantom{x}}$$

(8)...   Area of ring $= (29\cdot5 + 25\cdot5) \times (29\cdot5 - 25\cdot5) \times \cdot7854$

$= 55$ ft. $\times 4$ ft. $\times \cdot7854$

$= 220$ sq. ft. $\times \cdot7854$

$= 172\cdot788$ sq. ft.

(9)...   Area of circle $= 25^2 \times 3\cdot1416$

$= 625$ sq. ft. $\times 3\cdot1416$

$= 1963\cdot5$ sq. ft.

$$\qquad\qquad\qquad\overset{\text{sq. ft.}}{\phantom{x}}\qquad\qquad\overset{\text{sq. ft.}}{\phantom{x}}$$

360°  :  66°  ::  1963·5  :  359·975, area of sector

(10)...   Area of circular end $= 64^2 \times \cdot07958$

$= 4096$ sq. in. $\times \cdot07958$

$= 325\cdot95968$ sq. in.

Contents of roller $= 325\cdot95968$ sq. in. $\times 78$ in.

$= 25424\cdot85504$ cu. in.

$= 14$ cu. ft. $1232\cdot85504$ cu. in.

## EXERCISE XXXVIII.

(1)...   16 acres, 30 perches $= 161\cdot875$ sq. chains

Breadth of field $= 161\cdot875$ sq. ch.$\div 17\cdot5$ ch. $= 9\cdot25$ chains

$$\qquad\qquad\qquad\qquad\overset{\text{in.}}{\phantom{x}}\quad\overset{\text{in.}}{\phantom{x}}$$

(2)...   Mean width of plank $= \frac{1}{2}(16\frac{1}{2} + 10\frac{1}{2}) = 13\frac{1}{2}$ in.

Area of plank $= 17\frac{1}{2}$ ft. $\times 1\frac{1}{8}$ ft. $= 19\frac{11}{16}$ sq. ft. $= 19$ sq. ft. 99 sq. in.

Value $19\frac{11}{16}$ sq. ft. at $8d.$ per ft. $= 13s.$ $1\frac{1}{2}d.$

|       | ft. | in. |   |       | ft. | in. |
|-------|-----|-----|---|-------|-----|-----|
| (3)...| 13  | 8   |   |       | 16  | 0   |
|       | 13  | 8   |   |       | 11  | 5   |
|       | 177 | 8   |   |       | 176 | 0   |
|       | 9   | 1   | 4 |       | 6   | 8   |
|       | 186 | 9   | 4 |       | 182 | 8   |

$$\begin{array}{lccc} & \text{ft.} & ' & '' \\ \text{Area of square} & 186 & 9 & 4 \\ \text{do. of parall}^{\text{m}}. & 182 & 8 & \end{array}$$

The square is the larger by $\overline{4\,\text{ft.}\;1'\;4''} = 4$ sq. ft. 16 sq. in.

(4)...  Area of floor $= 55\frac{1}{2}$ ft. $\times 26\frac{1}{4}$ ft. $= 1456\frac{7}{8}$ sq. ft.

Area of 1 yd. matting $= 3$ ft. $\times 2\frac{5}{8}$ ft. $= 7\frac{7}{8}$ sq. ft.

Matting required $1456\frac{7}{8} \div 7\frac{7}{8} = 185$ yds.

Cost, 185 yds. of matting, at 1s. 6d. per yd. $= £13$ 17s. 6d.

(5)...           Area of circle $= 55^2 \times \cdot 07958$

$= 3025$ sq. in. $\times \cdot 07958$

$= 240 \cdot 7295$ sq. in.

Side of square $= \sqrt{240 \cdot 7295} = 15 \cdot 5154$ in.

(6)...  Base of triangle $= (40$ sq. yds. $\div 40$ ft.$) \times 2$

$= (360$ sq. ft. $\div 40$ ft.$) \times 2$

$= 9$ ft. $\times 2 = 18$ ft.

Each equal side $= \sqrt{40^2 + 9^2}$

$= \sqrt{1600 + 81}$

$= \sqrt{1681}$

$= 41$ ft.

(7)...



$$27$$
$$39$$
$$52$$
$$2)\overline{118}$$
$$59$$
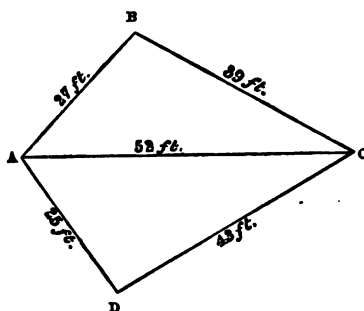
$$59 - 27 = 32$$
$$59 - 39 = 20$$
$$59 - 52 = 7$$

$$59 \times 32 \times 20 \times 7 = 264320$$

Area of triangle ABC = $\sqrt{264320}$ = 514·1206 sq. ft.

$$25$$
$$43$$
$$52$$
$$2)\overline{120}$$
$$60$$

$$60 - 25 = 35$$
$$60 - 43 = 17$$
$$60 - 52 = 8$$

$$60 \times 35 \times 17 \times 8 = 285600$$

Area of triangle ACD = $\sqrt{285600}$ = 534·4155 sq. ft.

$$514·1206$$
$$534·4155$$

Area of trapezium ABCDA = $\overline{1048·5361}$ sq. ft.

(8)...    Area of semicircle = $\frac{1}{2}(65^2 \times 3·1416)$
$$= \frac{1}{2}(4225 \text{ sq. ft.} \times 3·1416)$$
$$= \frac{1}{2}(13273·26 \text{ sq. ft.})$$
$$= 6636·63 \text{ sq. ft.}$$
$$= 737 \text{ sq. yds. } 3·63 \text{ sq. ft.}$$

(9)...     Area of bottom of cistern

= 7 ft. 9 in. × 3 ft. 9 in. = 93 in. × 45 in. = 4185 sq. in.

Capacity = $277\frac{1}{4}$ cu. in. × 540 = 149715 cu. in.

Depth = 149715 cu. in. ÷ 4185 sq. in. = $35\frac{24}{31}$ in.

(10)...     See Appendix, page 180.

Area of base of cone = $33^2$ × ·07958

= 1089 sq. ft. × ·07958

= 86·66262 sq. ft.

Solidity of cone = $\frac{1}{3}$(86·66262 sq. ft. × 35 ft.)

= $\frac{1}{3}$(3033·1917 cu. ft.)

= 1011·0639 cu. ft.

## EXERCISE XXXIX.

(1)...     $42\cdot416° = 42\frac{5}{12}° = 42°\ \ 25'$
          $63\cdot83° = 63\frac{5}{6}° = \underline{63°\ \ 50'}$
          $106°\ \ 15'$

$180° - 106°\ 15' = 73°\ 45'$

(2)...     2725 links × 2725 links = 7425625 sq. links

= 74 ac. 1 ro. 1 po.

Value, 74 ac. 1 ro. 1 po. at £84 per acre = £6237 10s. 6d.

(3)...
$$\begin{array}{r} \overset{\text{ft.}}{29\cdot375} + \overset{\text{ft.}}{21\cdot3125} = \overset{\text{ft.}}{50\cdot6875} \\ 17\cdot6 \\ \hline 3041250 \\ 3548125 \\ 506875 \\ \hline 2)892\cdot10000 \end{array}$$

Area of trapezoid = $446\cdot05$ = $446\frac{1}{20}$ sq. ft.

(4)...
$$
\begin{array}{l}
23 \\
29 \\
\underline{44} \\
2)\overline{96} \\
\overline{48}
\end{array}
\qquad
\begin{array}{l}
48-23 = 25 \\
48-29 = 19 \\
48-44 = \ 4
\end{array}
$$

$$48 \times 25 \times 19 \times 4 = 91200$$

Area of scalene triangle $= \sqrt{91200} = 301 \cdot 993$ sq. ft.

Side of equilateral triangle $= 32$ ft.     $48-32 = 16$

$$48 \times 16 \times 16 \times 16 = 196608$$

Area of equilateral triangle $= \sqrt{196608} = 443 \cdot 405$ sq. ft.

$$
\begin{array}{l}
443 \cdot 405 \\
301 \cdot 993
\end{array}
$$

The equilateral triangle is larger by $\overline{141 \cdot 412}$ sq. ft.

 

(5)... Perimeter of room $= (18\frac{1}{4} + 15\frac{1}{2}) \times 2 = 67\frac{1}{2}$ ft. $= 810$ in.

Area of walls $= 810$ in. $\times 112$ in. $= 90720$ sq. in.

Area of each stamp $= \frac{7}{8}$ in. $\times \frac{3}{4}$ in. $= \frac{21}{32}$ of a sq. in.

No. of stamps required $= 90720 \div \frac{21}{32} = 138240$

 

(6)... Area of ring $= (33+28) \times (33-28) \times \cdot 7854$

           $= 61$ ft. $\times 5$ ft. $\times \cdot 7854$

           $= 305$ sq. ft. $\times \cdot 7854$

           $= 239 \cdot 547$ sq. ft.

 

(7)... Area of drawing-room floor $= 26\frac{1}{4}$ ft. $\times 23$ ft.

           $= 603\frac{3}{4}$ sq. ft.

Area of dining-room floor $= 31\frac{1}{2}$ ft. $\times 19\frac{1}{8}$ ft.

           $= 603\frac{3}{4}$ sq. ft.

Area of both floors, $1207\frac{1}{2}$ sq. ft.

Area of 1 yd. carpeting $= 3$ ft. $\times 1\frac{11}{12}$ ft. $= 5\frac{3}{4}$ sq. ft.

Carpeting required, $1207\frac{1}{2} \div 5\frac{3}{4} = 210$ yds.

Cost, 210 yds. carpeting, at 4s. 11d. per yd. $= £51$ 12s. 6d.

(8)...     AC = 61 in.     BC = 11 in.

$$AB = \sqrt{AC^2 - BC^2}$$
$$= \sqrt{61^2 - 11^2}$$
$$= \sqrt{3721 - 121}$$
$$= \sqrt{3600}$$
$$= 60 \text{ in.} = 5 \text{ ft.}$$
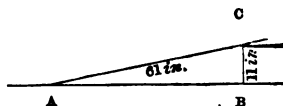


(9)...     Mean depth $= \frac{1}{2}(6\frac{1}{2} + 2\frac{1}{2}) = 4\frac{1}{2}$ ft.

40 yds. × 12 yds. × 4½ ft. = 1440 in. × 432 in. × 54 in.

$$= 33592320 \text{ cu. in.}$$

33592320 ÷ 277·274 = 121152·0734 gallons

(10)...
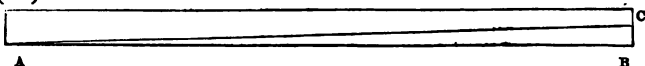


AB = 40 yds. = 120 ft.     BC = 6½ ft. − 2½ ft. = 4 ft.

Length of sloping bottom $= \sqrt{120^2 + 4^2}$
$$= \sqrt{14400 + 16}$$
$$= \sqrt{14416}$$
$$= 120·066 \text{ ft.}$$

Area of bottom = 120·066 ft. × 36 ft. = 4322·376 sq. ft.
$$= 480·264 \text{ sq. yds.}$$

480¼ sq. yds. at 3s. per yd. = £72 0s. 9d.

## EXERCISE XL.

(1)...

Altitude of triangle = (104 sq. ft. 4 sq. in. ÷ 17 ft. 10 in.) × 2
$$= (14980 \text{ sq. in.} ÷ 214 \text{ in.}) × 2$$
$$= 70 \text{ in.} × 2$$
$$= 140 \text{ in.} = 11 \text{ ft. 8 in.}$$

(2)...Perpendicular height of triangle

$$= \sqrt{106^2 - 56^2}$$
$$= \sqrt{11236 - 3136}$$
$$= \sqrt{8100}$$
$$= 90 \text{ yds.}$$

Area of triangle $= \frac{1}{2}(56 \text{ yds.} \times 90 \text{ yds.})$
$$= \frac{1}{2}(5040 \text{ sq. yds.})$$
$$= 2520 \text{ sq. yds.}$$

(3)...    5 ac. 2 ro. 36 per. 26 sq. yds. = 27735 sq. yds.

Let $5x$ = length of field, in yards
and $3x$ = breadth of    „       „

Then, area $= 15x^2 = 27735$
$$x^2 = 1849$$
$$x = 43$$

Hence, Length of field $= 5x = 215$ yds.
Breadth of    „    $= 3x = 129$ yds.

(4)...    6 ac. 3 ro. 3 per. $7\frac{1}{4}$ sq. yds. = 32768 sq. yds.

Length of diagonal path $= \sqrt{32768 \times 2}$
$$= \sqrt{65536}$$
$$= 256 \text{ yds}$$

(5)...Area of floor
$$= (19\frac{2}{3} \text{ ft.} \times 16\frac{1}{2} \text{ ft.}) + (5\frac{1}{3} \text{ ft.} \times 1\frac{1}{2} \text{ ft.} \times 2)$$
$$= 324\frac{1}{2} \text{ sq. ft.} + 16 \text{ sq. ft.}$$
$$= 340\frac{1}{2} \text{ sq. ft.}$$
$$= 37\frac{5}{6} \text{ sq. yds}$$

(6)...Area of parallelogram ABCD
$$= 35 \text{ ft.} \times 12 \text{ ft.} = 420 \text{ sq. ft.}$$

Area of semicircular top
$$= \tfrac{1}{2}(12^2 \times \cdot 7854)$$
$$= \tfrac{1}{2}(144 \text{ sq. ft.} \times \cdot 7854)$$
$$= \tfrac{1}{2}(113 \cdot 0976 \text{ sq. ft.})$$
$$= 56 \cdot 5488 \text{ sq. ft.}$$
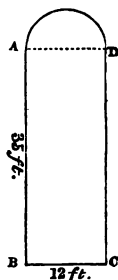
420
56·5488
Area of window $= \overline{476 \cdot 5488}$ sq. ft.

(7)... Circumference of circle $= 27 \cdot 875$ ft. $\times 2 \times 3 \cdot 1416$
$$= 175 \cdot 1442 \text{ ft.}$$

ft.         ft.
360° : 43° 52′ 30″ :: 175·1442 : 21·345699375

(8)...
ft.  in.        ft.  in.
$(2 \quad 10\tfrac{1}{2})^3$ : $(3 \quad 10)^3$
$(34\tfrac{1}{2})^3$ : $(46)^3$
$3^3$ : $4^3$
$27$ : $64$

(9)...
lb.        lb.       cu. ft.     cu. ft.
$168\tfrac{3}{4}$ : $560$ :: $1$ : $3\tfrac{43}{135}$

Contents of block $= 3\tfrac{43}{135}$ cu. ft. $= 3$ cu. ft. $550\tfrac{2}{3}$ cu. in.

(10)... 1 cu. ft. of gunpowder weighs 932 oz. $= 58\tfrac{1}{4}$ lb.

Capacity of box, $2\tfrac{2}{3}$ ft. $\times 1\tfrac{1}{2}$ ft. $\times 1\tfrac{9}{24}$ ft. $= 5\tfrac{1}{2}$ cu. ft.

Weight of gunpowder, $58\tfrac{1}{4}$ lb. $\times 5\tfrac{1}{2} = 320\tfrac{3}{8}$ lb.

H H

*EXERCISE XLI.*

(1)...Area of parallelogram, 980 sq. ft. 28 sq. in.=141148 sq. in.

Let $7x$ = the length, in inches

and $4x$ = the breadth     „

Then, area = $28x^2$ = 141148

$$x^2 = 5041$$

$$x = 71$$

Hence, the length = $71 \times 7$ = 497 in. = 41 ft. 5 in.

the breadth = $71 \times 4$ = 284 in. = 23 ft. 8 in.

(2)...   Let $20x$ = the base of the triangle, in feet

and $21x$ = the perpendicular  „        „

Then, area = $\frac{1}{2}(20x \times 21x)$ = $210x^2$

$210x^2 = 583\frac{1}{3}$ sq. yds. = 5250 sq. ft.

$$x^2 = 25$$

and $x = 5$

Hence, Base of triangle = $5 \times 20$ = 100 ft.

Perpendicular   = $5 \times 21$ = 105 ft.

Hypotenuse    = $\sqrt{100^2 + 105^2}$

= $\sqrt{10000 + 11025}$

= $\sqrt{21025}$

= 145 ft.

(3)...     165 square miles = 105600 acres

$$\tfrac{15000}{105600} + \tfrac{800}{800} = \tfrac{25}{176}$$

**(4)**...Side of required square

$$= \sqrt{18^2 + (22\tfrac{1}{2})^2 + 24^2}$$
$$= \sqrt{324 + 506 \cdot 25 + 576}$$
$$= \sqrt{1406 \cdot 25}$$
$$= 37 \cdot 5 = 37\tfrac{1}{2} \text{ yds.}$$

**(5)**...Perimeter of room $= (27\tfrac{1}{3}$ ft. $+ 20\tfrac{1}{3}$ ft.$) \times 2 = 95\tfrac{1}{3}$ ft.

Area of walls $= 95\tfrac{1}{3}$ ft. $\times 11$ ft. $= 1048\tfrac{2}{3}$ sq. ft.

Area of 1 piece of paper $= 3$ ft. $\times 1\tfrac{5}{6}$ ft. $\times 12 = 66$ sq. ft.

Paper required, $1048\tfrac{2}{3} \div 66 = 15\tfrac{8}{9}$ pieces

**(6)**...Circumference of circle $= 85$ ft. $\times 2 \times 3 \cdot 1416 = 534 \cdot 072$ ft.

$$= 178\tfrac{3}{125} \text{ yds.}$$

Cost of fencing, $178\tfrac{3}{125}$ yds. at $15d.$ per yd. $= \pounds 11\ 2s.\ 6\tfrac{9}{25}d.$

**(7)**... Area of circle $= 10^2 \times 3 \cdot 1416$

$$= 100 \text{ sq. in.} \times 3 \cdot 1416$$
$$= 314 \cdot 16 \text{ sq. in.}$$

$$360^\circ \ :\ 51^\circ\ 45' \ ::\ \overset{\text{sq. in.}}{314 \cdot 16} \ :\ \overset{\text{sq. in.}}{45 \cdot 1605,} \text{ area of sector}$$

**(8)**...1 cubic foot of the marble weighs 2700 oz. $= 168\tfrac{3}{4}$ lb.

Contents of block, $4\tfrac{5}{6}$ ft. $\times 1\tfrac{5}{6}$ ft. $\times 1\tfrac{1}{4}$ ft. $= 11\tfrac{11}{144}$ cu. ft.

Weight of block $= 168\tfrac{3}{4}$ lb. $\times 11\tfrac{11}{144} = 1869\tfrac{9}{64}$ lb.

$$= 16 \text{ cwt. } 2 \text{ qrs. } 21\tfrac{9}{64} \text{ lb.}$$

H H 2

(9)...    Contents of stack $= 10\frac{2}{3}$ yds. $\times 7\frac{1}{3}$ yds. $\times 7\frac{1}{3}$ ft.

$= 384$ in. $\times 264$ in. $\times 88$ in.

$= 8921088$ cu. in.

Contents of each stone, $8921088$ cu. in. $\div 14724 = 512$ cu. in.

$\sqrt[3]{512} = 8$, $\therefore$ each stone is a cube of 8 inches

(10)...    Area of mouth of well $= (4\frac{1}{4})^2 \times \cdot7854$ ft.

$= 18\cdot0625$ sq. ft. $\times \cdot7854$

$= 14\cdot1862875$ sq. ft.

$14\cdot1862875$ sq. ft. $\times 330$ ft. $= 4681\cdot474875$ cu. ft.

## EXERCISE XLII.

(1)...    Area of parallelogram $= 250$ yds. $\times 55\cdot225$ yds.

$= 13806\cdot25$ sq. yds.

Side of square $= \sqrt{13806\cdot25} = 117\cdot5$ yds. $= 117\frac{1}{2}$ yds.

(2)...    Area of field $= \frac{1}{2}(1045 + 1275) \times 775$ li.  li.  li.

$= \frac{1}{2}(2320$ li. $\times 775$ li.$)$

$= \frac{1}{2}(1798000$ sq. li.$)$

$= 899000$ sq. li.

$= 8$ ac. $3$ ro. $38\cdot4$ po.

(3)...    $20000$ acres $= 96800000$ sq. yds.

$23$ miles $= 40480$ yds.

Average breadth $= 96800000$ sq. yds. $\div 40480$ yds.

$= 2391\frac{7}{23}$ yds.

(4)...    Let $8x$ = the base of the triangle, in inches

and $15x$ = the perpendicular of ,,    ,,

Then, the hypotenuse = $\sqrt{(8x)^2 + (15x)^2}$

$$= \sqrt{64x^2 + 225x^2}$$

$$= \sqrt{289x^2}$$

$$= 17x$$

Now, $17x$ = 19 ft. 10 in. = 238 in.

$$\therefore x = 14$$

Hence, the base of the triangle = 14 in. × 8 = 9 ft. 4 in.

And the perpendicular    ,,    = 14 in. ×15 = 17 ft. 6 in.

```
            ft.  in.
            17   6
             9   4
           ───────
           157   6
             5  10
           ────────
         2)163   4
           ────────
            81   8
```

Area of triangle =    81  8 = 81 sq. ft. 96 sq. in.

(5)...    Perimeter of room = $(28 + 22\frac{1}{2}) \times 2$ = 101 ft.

Area of walls = 101 ft. × 10 ft. = 1010 sq. ft.

Area of ceiling = 28 ft. × $22\frac{1}{2}$ ft. = 630 sq. ft.

Area of two windows = 7 ft. × 4 ft. × 2 ft. = 56 sq. ft.

Area of door = $7\frac{1}{2}$ ft. × $4\frac{1}{6}$ ft. = $31\frac{1}{4}$ sq. ft.

Area of fireplace = 5 ft. × 5 ft. = 25 sq. ft.

1010 sq. ft. + 630 sq. ft. = 1640 sq. ft.

56 sq. ft. + $31\frac{1}{4}$ sq. ft. + 25 sq. ft. = $112\frac{1}{4}$ sq. ft.

Area of painting = $1527\frac{3}{4}$ sq. ft. = $169\frac{3}{4}$ sq. yds.

Cost, $169\frac{3}{4}$ sq. yds. at 8d. per sq. yd. = £5 13s. 2d.

(6)...        Area of floor $=$ 630 sq. ft.

Area of 1 yd. of carpeting $=$ 3 ft. $\times 2\frac{1}{4}$ ft. $= 6\frac{3}{4}$ sq. ft.

Carpeting required, $630 \div 6\frac{3}{4} = 93\frac{1}{3}$ yds.

Cost, $93\frac{1}{3}$ yds. of carpeting, at 4s. 3d. per yd. $= £19$ 16s. 8d.


in. 'in.  in.
(7)...Contents of block $= 64 \times 44 \times 30\frac{1}{4} = 85184$ cu. in.

The edge of a cube of equal volume

$= \sqrt[3]{85184} = 44$ in. $=$ 3 ft. 8 in.


(8)...        $37\frac{1}{2}$ mi. $=$ 66000 yds.

Mean width of canal $= \frac{1}{2}(18+16) = 17$ yds.

66000 yds. $\times 17$ yds. $\times 2\frac{1}{3}$ yds. $=$ 2618000 cu. yds.

Cost of excavating, 2618000 cu. yds. at $7\frac{1}{2}d.$ per cu. yd.

$= £81812$ 10s.


(9)...   Radius of flower-bed $= \sqrt{(45 \times 2) \div 3\cdot1416}$

$= \sqrt{28\cdot647822}$

$= 5\cdot352$ ft.

(10)...,        8                    $12-8 = 4$
               3
             2)24               $12 \times 4 \times 4 \times 4 = 768$
             ‾‾12

Area of base $= \sqrt{768} = 27\cdot7128$ sq. ft.

Solidity of pyramid $= \frac{1}{3}(27\cdot7128$ sq. ft. $\times 13\frac{1}{2}$ ft.$)$

$= \frac{1}{3}(374\cdot1228$ cu. ft.$)$

$= 124\cdot7076$ cu. ft.

## EXERCISE XLIII.

(1)...     £1124 11s.+2s. 10d. = 269892d.÷34d.
                          = 7938, No. sq. yds.

Let $x$ = the breadth of the ground, in yds.
and $2x$ = the length      ,,      ,,      ,,

The area = $2x^2$ = 7938
                    $x^2$ = 3969
                    $x$  = 63

Hence, the breadth = 63 yds. and the length = 126 yds.

(2)...          11  :  14  ::  $137\frac{5}{33}$  :  $x$

$$x = \frac{1}{11} \times \frac{14}{1} \times \frac{4389}{32} = \frac{2793}{16} \text{ mi.} = 174 \text{ mi. 4 fur. 110 yds.}$$

(3)...   Circumference of circle = 15·125 ft. × 2 × 3·1416
                                = 95·0334 ft.

360°  :  28° 7′ 30″  ::  95·0334 ft.  :  7·424484375 ft.

(4)...        OA = $4\frac{1}{4}$ mi. × 6 = $25\frac{1}{2}$ mi.
              OB = 36 mi. × 6 = 216 mi.

AB = $\sqrt{(25\frac{1}{2})^2 + 216^2}$
   = $\sqrt{650\cdot25 + 46656}$
   = $\sqrt{47306\cdot25}$
   = 217·5 mi. = $217\frac{1}{2}$ mi.
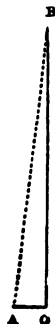
(5)...        Area of circle $= (17\frac{3}{4}$ ft.$)^2 \times 3\cdot1416$

$\qquad\qquad\qquad = 315\cdot0625$ sq. ft. $\times 3\cdot1416$

$\qquad\qquad\qquad = 989\cdot80035$

$\qquad\qquad\qquad\qquad\overset{\text{sq. ft.}}{\phantom{x}}\qquad\qquad\overset{\text{sq. ft.}}{\phantom{x}}$
$360° \;:\; 50°\ 24' \;::\; 989\cdot80035 \;:\; 138\cdot572049,$ area of sector

(6)...        1 cu. ft. of ivory weighs 1825 oz.

$\qquad (1\frac{3}{4})^3 = (\frac{7}{4})^3 = \frac{343}{64} = 5\frac{23}{64} = 5\cdot359375$ cu. in.

$\quad\overset{\text{cu. in.}}{1728} \;:\; \overset{\text{cu. in.}}{5\cdot359375} \;::\; \overset{\text{oz.}}{1825} \;:\; \overset{\text{oz.}}{5\cdot6602195}$

(7)...Dimensions on the outer side of the ditch,

$\qquad$ Length, 225 yds. $+ (4\frac{1}{2}$ ft. $\times 2) = 228$ yds.

$\qquad$ Breadth, 185 yds. $+ (4\frac{1}{2}$ ft. $\times 2) = 188$ yds.

$\qquad\qquad\qquad\overset{\text{yds.}}{\phantom{x}}\ \overset{\text{yds.}}{\phantom{x}}\qquad\overset{\text{yds.}}{\phantom{x}}\ \overset{\text{yds.}}{\phantom{x}}$
$\qquad$ Surface of ditch $= (228 \times 188) - (225 \times 185)$

$\qquad\qquad\qquad = 42864$ sq. yds. $- 41625$ sq. yds.

$\qquad\qquad\qquad = 1239$ sq. yds.

$\qquad$ Earth taken out, 1239 sq. yds. $\times \frac{3}{4}$ yd. $= 929\frac{1}{4}$ cu. yds.

(8)...        $929\frac{1}{4}$ cu. yds. $= 43355088$ cu. in.

$\qquad$ Surface of field $= 41625$ sq. yds. $= 53946000$ sq. in.

$\qquad$ 43355088 cu. in. $\div 53946000 = \cdot80367$ of an inch

(9)...See Appendix, page 180

$\qquad$ Surface of globe $= (1$ yd.$)^2 \times 3\cdot1416$

$\qquad\qquad\qquad\quad = 3\cdot1416$ sq. yds.

$\quad\overset{\text{sq. yd.}}{1} \;:\; \overset{\text{sq. yds.}}{3\cdot1416} \;::\; \overset{s.\ \ d.}{1\ \ 6} \;:\; \overset{s.\ \ d.}{4\ \ 8\frac{1}{2}}$

(10)...Capacity of punch-bowl

$$= \tfrac{1}{2}(15^3 \times \cdot 5236)$$
$$= \tfrac{1}{2}(3375 \text{ cu. in.} \times \cdot 5236)$$
$$= \tfrac{1}{2}(1767 \cdot 15 \text{ cu. in.})$$
$$= 883 \cdot 575 \text{ cu. in.}$$
$$= 3 \cdot 186 \text{ gal.}$$

## EXERCISE XLIV.

(1)...     Area of field $= \tfrac{1}{2}(1760 \text{ li.} \times 2450 \text{ li.})$

$$= \tfrac{1}{2}(4287500 \text{ sq. li.})$$
$$= 2143750 \text{ sq. li.}$$
$$= 21 \text{ ac. 1 ro. 30 per.}$$

(2)...     2 cu. ft. 1457 cu. in. $= 4913$ cu. in.

Edge of cube $= \sqrt[3]{4913} = 17$ in. $= 1$ ft. 5 in.

```
                    ft.  in.
                     1   5
                     1   5
                    ———————
                     1   5
                          7  1
Surface of each side =  2   0  1
                              6
Whole surface =   12   0   6  = 12 sq. ft. 6 sq. in.
```

(3)...12 angles of dodecagon $+ 4$ rt. angles $= 24$ rt. angles

12 angles of dodecagon $= 20$ rt. angles

Each angle of dodecagon $= \tfrac{5}{3}$ of a rt. angle

$$= \tfrac{5}{3} \text{ of } 90°$$
$$= 150°$$

(4)...               $3\frac{3}{4}$ ac. = 18150 sq. yds.

Diameter of field = $\sqrt{18150 \div \cdot 7854}$

= $\sqrt{23109 \cdot 243697}$

= 152·017 yds.


(5)...          $(7\frac{1}{2})^2$ : $(8\frac{3}{4})^2$ : $(11\frac{1}{4})^2$

$6^2$ : $7^2$ : $9^2$

36 : 49 : 81


(6)...      Area of ellipse = 25 in. × 18 in. × ·7854

= 450 sq. in. × ·7854

= 353·43 sq. in.

= 2 sq. ft. 65·43 sq. in.


(7)...Contents of block = $6\frac{2}{3}$ ft. × $1\frac{1}{2}$ ft. × $1\frac{1}{2}$ ft. = 15 cu. ft.

Weight of block = $169\frac{3}{4}$ lb. × 15

= $2546\frac{1}{4}$ lb.

= 1 ton 2 cwt. 2 qrs. $26\frac{1}{4}$ lb.


(8)...Capacity of tank, 277·274 cu. in. × 1000 = 277274 cu. in.

$45\frac{15}{16}$ sq. ft. = 6615 sq. in.

Depth of tank = 277274 cu. in. ÷ 6615 sq. in.

= 41·915 in.

= 3 ft. 5·915 in.

(9)... Inside dimensions of chest :—length, 5 ft. 1 in.,
breadth, 2 ft., depth, 1 ft. 10 in.

$$\text{Wood in chest} = \overset{\text{ft.}}{(5\tfrac{1}{4}} \times \overset{\text{ft.}}{2\tfrac{1}{6}} \times \overset{\text{ft.}}{2)} - \overset{\text{ft.}}{(5\tfrac{1}{12}} \times \overset{\text{ft.}}{2} \times \overset{\text{ft.}}{1\tfrac{5}{6})}$$

$$= 22\tfrac{3}{4} \text{ cu. ft.} - 18\tfrac{23}{36} \text{ cu. ft.} = 4\tfrac{1}{9} \text{ cu. ft.}$$

1 cu. ft. of oak weighs 925 oz.

$$\text{Weight of oak} = 925 \text{ oz.} \times 4\tfrac{1}{9} = 3802\tfrac{7}{9} \text{ oz.}$$

$$= 2 \text{ cwt. } 13 \text{ lb. } 10 \tfrac{7}{9} \text{ oz.}$$

(10)... $\overset{\text{in.}}{42} \times \overset{\text{in.}}{(1\tfrac{1}{2})^2} \quad : \quad \overset{\text{in.}}{70} \times \overset{\text{in.}}{(2\tfrac{5}{6})^2} \quad :: \quad \overset{\text{lb.}}{21\tfrac{1}{2}} \quad : \quad x$

$$x = \{70 \times (2\tfrac{5}{6})^2 \times 21\tfrac{1}{2}\} \div \{42 \times (1\tfrac{1}{2})^2\}$$

$$= \frac{\overset{35}{\cancel{70}}}{1} \times \frac{\cancel{17}}{\underset{4}{\cancel{6}}} \times \frac{\cancel{17}}{8} \times \frac{43}{\cancel{2}} \times \frac{1}{\underset{\cancel{3}}{\cancel{42}}} \times \frac{\overset{7}{\cancel{2}}}{\cancel{3}} \times \frac{\cancel{2}}{3}$$

$$= \tfrac{10535}{96} \text{ lb.} = 109\tfrac{71}{96} \text{ lb.} = 109 \text{ lb. } 11\tfrac{5}{6} \text{ oz.}$$

## EXERCISE XLV.

(1)... Side of triangle = 140 yds.

$$\begin{array}{r} 2)420 \\ \hline 210 \end{array} \qquad 210 - 140 = 70$$

$$210 \times 70 \times 70 \times 70 = 72030000$$

$$\text{Area of triangle} = \sqrt{72030000} = 8487 \cdot 0489 \text{ sq. yds.}$$

(2)... $\text{Area of circle} = \overset{\text{ft.}}{(17\tfrac{1}{2})^2} \times 3 \cdot 1416$

$$= 306 \cdot 25 \text{ sq. ft.} \times 3 \cdot 1416$$

$$= 962 \cdot 115 \text{ sq. ft.}$$

$$360° \quad : \quad 25° \quad :: \quad \overset{\text{sq. ft.}}{962 \cdot 115} \quad : \quad \overset{\text{sq. ft.}}{66 \cdot 8135416}, \text{ area of sector}$$

(3)...     60 cu. ft. 143 cu. in. = 103823 cu. in.

Edge of cube $= \sqrt[3]{103823} = 47$ in. $= 3$ ft. 11 in.

$$
\begin{array}{rrr}
\text{ft.} & \text{in.} & \\
3 & 11 & \\
3 & 11 & \\
\hline
11 & 9 & \\
3 & 7 & 1 \\
\hline
15 & 4 & 1 \\
& & 6 \\
\hline
92 & 0 & 6 \\
\end{array}
$$

Surface of each side $= 15 \quad 4 \quad 1$

Whole surface $= 92 \quad 0 \quad 6 = 92$ sq. ft. 6 sq. in.

(4)...     165 yds. $\times 82\frac{1}{2}$ yds. $= 13612\frac{1}{2}$ sq. yds. $= 2\frac{13}{16}$ ac.

Value of field, £64 $\times 2\frac{13}{16} = $ £180

Perimeter of field $= (\overset{\text{yds.}}{165} + \overset{\text{yds.}}{82\frac{1}{2}}) \times 2 = 495$ yds. $= 90$ ro.

Cost of fencing $= 8s. 9d. \times 90 = $ £39 7s. 6d.

(5)...     Area of walk $= (\overset{\text{ft.}}{235} + \overset{\text{ft.}}{225}) \times (\overset{\text{ft.}}{235} - \overset{\text{ft.}}{225}) \times \cdot 7854$

$= 460$ ft. $\times 10$ ft. $\times \cdot 7854$

$= 4600$ sq. ft. $\times \cdot 7854$

$= 3612 \cdot 84$ sq. ft.

$= 401 \cdot 426$ sq. yds.

(6)...     Diameter of circle $= \sqrt{1 \div \cdot 7854}$

$= \sqrt{1 \cdot 2732365673}$

$= 1 \cdot 12837$ ft.

(7)...Area of each end of cylinder

$$= (5\cdot25)^2 \times \cdot07958$$
$$= 27\cdot5625 \text{ sq. ft.} \times \cdot07958$$
$$= 2\cdot19342375 \text{ sq. ft.}$$

Whole surface of cylinder

$$= (5\cdot25 \text{ ft.} \times 15 \text{ ft.}) + (2\cdot19342375 \text{ sq. ft.} \times 2)$$
$$= 78\cdot75 \text{ sq. ft.} + 4\cdot3868475 \text{ sq. ft.}$$
$$= 83\cdot1368475 \text{ sq. ft.}$$

(8)...Area of bottom of tank $= 8\frac{1}{4}$ ft. $\times 3\frac{3}{4}$ ft. $=$ $\;\;\;\;\;\;$ sq. ft. $30\frac{15}{16}$
$\;\;\;\;$ Area of two sides $= 8\frac{1}{4}$ ft. $\times 3\frac{1}{2}$ ft. $\times 2 ... =$ $57\frac{3}{4}$
$\;\;\;\;$ Area of two ends $= 3\frac{3}{4}$ ft. $\times 3\frac{1}{2}$ ft. $\times 2 ... =$ $26\frac{1}{4}$
$$\overline{114\frac{15}{16}}$$

Weight of the lead $= 7$ lb. $\times 114\frac{15}{16} = 804\frac{9}{16}$ lb.

$$= 7 \text{ cwt. } 20 \text{ lb. } 9 \text{ oz.}$$

Cost, 7 cwt. 20 lb. 9 oz. at 24s. 6d. per cwt. $= £8$ 15s. $11\frac{1}{1}\frac{2}{2}\frac{5}{5}d$.

(9)... $\;\;\;\;\;\;\;\;$ 1 cubic foot of iron weighs 7250 ounces

$\;\;\;\;\;$ oz. $\;\;\;\;\;\;$ lbs. $\;\;\;$ oz. $\;\;\;\;\;$ cu. in. $\;\;\;\;\;\;$ cu. in.
$\;\;\;\;$ 7250 $\;\;:\;\;$ 15 $=$ 240 $\;\;::\;\;$ 1728 $\;\;:\;\;$ $57\frac{1}{7}\frac{4}{2}\frac{7}{5}$

Length of rod $= 57\frac{1}{7}\frac{4}{2}\frac{7}{5}$ in. $= 4$ ft. $9\frac{1}{7}\frac{4}{2}\frac{7}{5}$ in.

(10)... $\;\;\;\;\;\;\;\;\;\;\;\;\;\;\;\;\;\;$ ft.
$\;\;\;\;\;\;\;\;\;\;\;\;\;\;\;\;$ Area of base $= (3\frac{1}{2})^2 \times \cdot7854$
$$= 12\frac{1}{4} \text{ sq. ft.} \times \cdot7854$$
$$= 9\cdot62115 \text{ sq. ft.}$$

Solidity of cone $= \frac{1}{3}(9\cdot62115 \text{ sq. ft.} \times 10\frac{1}{2} \text{ ft.})$
$$= \frac{1}{3}(101\cdot022075 \text{ cu. ft.})$$
$$= 33\cdot674025 \text{ cu. ft.}$$

## EXERCISE XLVI.

in.  in.
(1)...Mean width of each plank = $\frac{1}{2}(15+10)$ = $12\frac{1}{2}$ in.

Area of 16 planks = $13\frac{3}{4}$ ft. $\times 1\frac{1}{24}$ ft. $\times 16$ = $229\frac{1}{6}$ sq. ft.

Value, $229\frac{1}{6}$ sq. ft. at $7\frac{1}{2}d$. per ft. = £7 3s. 2$\frac{3}{4}d$.

(2)...     $229\frac{1}{6}$ sq. ft. $\times \frac{1}{12}$ ft. = $19\frac{7}{72}$ cu. ft.

1 cubic foot of fir weighs 550 ounces

Weight of planks = 550 oz. $\times 19\frac{7}{72}$ = $10503\frac{11}{36}$ oz.

= 5 cwt. 3 qrs. 12 lb. $7\frac{11}{36}$ oz.

(3)...     19 ft. $5\frac{1}{4}$ in. = 19·4375 ft.

Base of triangle = (173·72265625 sq. ft.÷19·4375 ft.) $\times 2$

= 8·9375 ft. $\times 2$

= 17·875 ft. = 17 ft. $10\frac{1}{2}$ in.

ft.  ft.     ft.  ft.
(4)...Area of foundation = $(25+21) \times (25-21) \times ·7854$

= 46 ft. $\times 4$ ft. $\times ·7854$

= 184 sq. ft. $\times ·7854$

= 144·5136 sq. ft.

(5)...     $2\frac{1}{2}$ acres = 12100 sq. yds.

Side of square plot = $\sqrt{12100}$ = 110 yds.

110 yds.$+$($12\frac{1}{2}$ yds. $\times 2$) = 135 yds.

Area of moat = $135^2-110^2$ = 18225$-$12100

= 6125 sq. yds.

(6)... Capacity of moat $= 6125$ sq. yds. $\times 2\frac{1}{2}$ yds.
$= 15312\frac{1}{2}$ cu. yds.
$= 714420000$ cu. in.
$714420000 \div 277 \cdot 274 = 2576584 \cdot 894$ gallons

(7)...
$\overset{\text{in.}}{(10\frac{1}{2})^3} \times 4 = 1157\frac{5}{8}$ cu. in. $\times 4 = 4630\frac{1}{2}$ cu. in.

Height of required cube $= \sqrt[3]{4630 \cdot 5} = 16 \cdot 667$ in.

(8)... 1 cubic foot of the stone weighs 2496 oz. $= 156$ lb.
Area of circular end $= 15^2 \times \cdot 7854$
$= 225$ sq. in. $\times \cdot 7854$
$= 176 \cdot 715$ sq. in.

Solidity of roller $= 176 \cdot 715$ sq. in. $\times 48$ in. $= 8482 \cdot 32$ cu. in.
$= 4 \cdot 90875$ cu. ft.

Weight of roller $= 156$ lb. $\times 4 \cdot 90875 = 765 \cdot 765$ lb.
$= 765$ lb. $12 \frac{6}{25}$ oz.

(9)...Diameter of inside of roller $= 15$ in. $- (\frac{3}{4}$ in. $\times 2) = 13\frac{1}{2}$ in.

Area of section of roller $= \overset{\text{in.}}{(15} + \overset{\text{in.}}{13\frac{1}{2})} \times \overset{\text{in.}}{(15} - \overset{\text{in.}}{13\frac{1}{2})} \times \cdot 7854$
$= 28\frac{1}{2}$ in. $\times 1\frac{1}{2}$ in. $\times \cdot 7854$
$= 42\frac{3}{4}$ sq. in. $\times \cdot 7854$
$= 33 \cdot 57585$ sq. in.

$33 \cdot 57585$ sq. in. $\times 48$ in. $= 1611 \cdot 6408$ cu. in.
1 cubic foot of iron weighs 7248 oz. $= 453$ lb.

cu. in.      cu. in.      lb.      lb.
$1728 \quad : \quad 1611 \cdot 6408 \quad :: \quad 453 \quad : \quad 422 \cdot 4961125$
Weight of iron roller $= 422 \cdot 4961125$ lb. $= 422$ lb. $7 \cdot 9378$ oz.

(10)...     Area of base $= 8^2 \times \cdot 07958$
$$= 64 \text{ sq. ft.} \times \cdot 07958$$
$$= 5 \cdot 09312 \text{ sq. ft.}$$

Solidity of cone $= \frac{1}{3}(5 \cdot 09312 \text{ sq. ft.} \times 9 \cdot 75 \text{ ft.})$
$$= \frac{1}{3}(49 \cdot 65792 \text{ cu. ft.})$$
$$= 16 \cdot 55264 \text{ cu. ft.}$$

## EXERCISE XLVII.

(1)...     Area of front $= 50 \text{ ft.} \times 28 \text{ ft.} = 1400 \text{ sq. ft.}$

8 windows, each $6 \text{ ft.} \times 3\frac{1}{2} \text{ ft.} = 168$ sq. ft.
3 ditto     each $4 \text{ ft.} \times 3\frac{1}{2} \text{ ft.} = \phantom{0}42$ ,,
       door $8 \text{ ft.} \times 4\frac{3}{4} \text{ ft.} = \phantom{0}\underline{38}$ ,,
                       $248$ ,,

Area coloured $1400 \text{ sq. ft.} - 248 \text{ sq. ft.} = 1152 \text{ sq. ft.}$
$$= 128 \text{ sq. yds.}$$

Cost of colouring, 128 sq. yds. at $3d.$ per yd. $= £1 \ 12s.$

(2)...     Let $9x =$ the base of the triangle, in feet,
and $19\frac{1}{4}x =$ the perpendicular of the triangle, in feet

Now, $(9x)^2 + (19\frac{1}{4}x)^2 = 170^2$
$$81x^2 + 370 \cdot 5625x^2 = 28900$$
$$451 \cdot 5625x^2 = 28900$$
$$x^2 = 64$$
$$x = 8$$

Hence, the base of the triangle $= 8 \times 9 = 72$ ft.
    the perpendicular $\phantom{000} = 8 \times 19\frac{1}{4} = 154$ ft.

Area of triangle $= \frac{1}{2}(72 \text{ ft.} \times 154 \text{ ft.})$
$$= \frac{1}{2}(11088 \text{ sq. ft.})$$
$$= 5544 \text{ sq. ft.}$$
$$= 616 \text{ sq. yds.}$$

(3)...
$$
\begin{array}{ll}
845 & 1610-\ \ 845 = 765 \\
1025 & 1610-1025 = 585 \\
1350 & 1610-1350 = 260 \\
\overline{2)3220} & \\
\overline{\ \ 1610} &
\end{array}
$$

$$1610 \times 765 \times 585 \times 260 = 187333970000$$

Area of field $= \sqrt{187333970000} = 432815$ sq. links

$$= 4 \text{ ac. } 1 \text{ ro. } 12\cdot 5 \text{ po.}$$

(4)...See Appendix, page 179, and Euclid, Book III. Prop. 22.

$$
\begin{array}{ll}
10 & 33-10 = 23 \\
17 & 33-17 = 16 \\
23 & 33-23 = 10 \\
16 & 33-16 = 17 \\
\overline{2)66} & \\
\overline{\ \ 33} &
\end{array}
$$

$$23 \times 16 \times 10 \times 17 = 62560$$

Area of figure $= \quad \overline{62560} = 250\cdot 119$ sq. ft.

(5)...    Let $x =$ the side of the given square, in feet

Then $x + 5 =$ the side of the enlarged square, in feet

$$\text{Now, } (x+5)^2 - x^2 = 295$$

$$i.e. \quad x^2 + 10x + 25 - x^2 = 295$$

$$\therefore 10x = 270$$

$$\text{and } x = 27$$

$\therefore$ the side of the original square $= 27$ ft.

(6)...    Radius of quadrant $= \sqrt{(490\cdot 875 \times 4) \div 3\cdot 1416}$

$$= \sqrt{1963\cdot 5 \div 3\cdot 1416}$$

$$= \sqrt{625}$$

$$= 25 \text{ yds.}$$

I. I

*a*             *b*

*c*          *e*

*d*         *f*
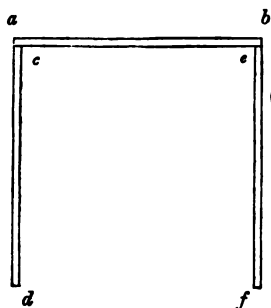
(7)...Side of court $= \sqrt{2756 \cdot 25}$

$$= 52 \cdot 5 = 52\tfrac{1}{2} \text{ ft.}$$

$$ab = 52\tfrac{1}{2} \text{ ft.} + (1\tfrac{7}{8} \text{ ft.} \times 2)$$
$$= 52\tfrac{1}{2} \text{ ft.} + 3\tfrac{3}{4} \text{ ft.}$$
$$= 56\tfrac{1}{4} \text{ ft.}$$

Length of wall $= ab + cd + ef$

$$= 56\tfrac{1}{4} \text{ ft.} + 52\tfrac{1}{2} \text{ ft.} + 52\tfrac{1}{2} \text{ ft.}$$

$$= 161\tfrac{1}{4} \text{ ft.}$$

Solidity of wall $= 161\tfrac{1}{4} \text{ ft.} \times 9\tfrac{1}{2} \text{ ft.} \times 1\tfrac{7}{8} \text{ ft.}$

$$= 2872\tfrac{17}{64} \text{ cu. ft.}$$

(8)...      $2872\tfrac{17}{64}$ cu. ft. $= 4963275$ cu. in.

Contents of each brick $= 9$ in. $\times 4\tfrac{1}{2}$ in. $\times 3$ in. $= 121\tfrac{1}{2}$ cu. in.

No. of bricks in wall $= 4963275 \div 121\tfrac{1}{2} = 40850$

(9)...      Area of circle $= 12^2 \times \cdot 07958$

$$= 144 \text{ sq. in.} \times \cdot 07958$$

$$= 11 \cdot 45952 \text{ sq. in.}$$

Capacity of mug $= 11 \cdot 45952$ sq. in. $\times 6\tfrac{1}{2}$ in.

$$= 74 \cdot 48688 \text{ cu. in.}$$

$$= 1 \cdot 0745 \text{ quart}$$

(10)...The hexagonal base consists of six equilateral triangles, the side of each triangle measuring $7\frac{1}{2}$ feet

$$7.5$$
$$3$$
$$2\overline{)22.5}$$
$$\overline{11.25}$$

$$11.25 - 7.5 = 3.75$$

$$11.25 \times 3.75 \times 3.75 \times 3.75 = 593.26171875$$

Area of each triangle $= \sqrt{593.26171875} = 24.356964$ sq. ft.

Area of base $= 24.356964$ sq. ft. $\times 6 = 146.141784$ sq. ft.

Volume of pyramid $= \frac{1}{3}(146.141784$ sq. ft. $\times 25$ ft.$)$

$$= \frac{1}{3}(3653.5446 \text{ cu. ft.})$$

$$= 1217.8482 \text{ cu. ft.}$$

$$= 1217 \text{ cu. ft. } 1465 \text{ cu. in.}$$

### EXERCISE XLVIII.

(1)...   60 sq. yds. 3 sq. ft. 18 sq. in. $= 543\frac{1}{8}$ sq. ft.

Breadth of room $= 543\frac{1}{8}$ sq. ft. $\div 27\frac{1}{2}$ ft.

$$= 19\frac{3}{4} \text{ ft.} = 19 \text{ ft. } 9 \text{ in.}$$

(2)...
| | |
|---|---|
| 180 | $430 - 180 = 250$ |
| 255 | $430 - 255 = 175$ |
| 175 | $430 - 175 = 255$ |
| 250 | $430 - 250 = 180$ |
| $2\overline{)860}$ | |
| $\overline{430}$ | |

$$250 \times 175 \times 255 \times 180 = 200812500$$

Area of figure $= \sqrt{200812500}$

$$= 44812 \text{ sq. yds.}$$

$$= 9 \text{ ac. } 1 \text{ ro. } 1 \text{ po. } 11\frac{3}{4} \text{ sq. yds.}$$

I I 2

(3)...         7 sq. ft. 16 sq. in. = 1024 sq. in.

Side of glass $= \sqrt{1024} = 32$ in.

Outside measurement of frame = 32 in. $+ (4$ in. $\times 2) = 40$ **in.**

Area of frame $= (\overset{\text{in.}}{40})^2 - (\overset{\text{in.}}{32})^2 = 1600$ sq. in. $- 1024$ sq. in.

$= 576$ sq. in. $= 4$ sq. ft.

Cost of frame, 4 sq. ft. at 12s. per ft. $= £2$ 8s.


(4)...         3 ro. 30 per. $= 4537\frac{1}{2}$ yds.

Diameter $= \sqrt{(4537 \cdot 5 \times 2) \div \cdot 7854}$

$= \sqrt{9075 \div \cdot 7854}$

$= \sqrt{11554 \cdot 621848}$

$= 107 \cdot 492$ yds.

Length of arc $= \frac{1}{2}(107 \cdot 492$ yds. $\times 3 \cdot 1416)$

$= \frac{1}{2}(337 \cdot 6968672$ yds.$)$

$= 168 \cdot 8484336$ yds.

Length of railing required

$= 107 \cdot 492$ yds. $+ 168 \cdot 848$ yds. $= 276 \cdot 34$ yds.


(5)...     Surface of sphere $= (\overset{\text{ft.}}{2 \cdot 25})^2 \times 3 \cdot 1416$

$= 5 \cdot 0625$ sq. ft. $\times 3 \cdot 1416$

$= 15 \cdot 90435$ sq. ft.

(6)...The extremity of the hour-hand moves $(5\frac{1}{4}$ in. $\times 2) \times 3\frac{1}{7}$
= 33 inches in 12 hours.

The extremity of the minute-hand moves (7 in. $\times 2) \times 3\frac{1}{7}$
= 44 inches in 1 hour, and 528 inches in 12 hours.

Hence, the ratio of their movements is

$$\text{as } 33 \quad : \quad 528$$
$$\text{or, as } 1 \quad ; \quad 16$$

(7)...Area of bottom of cistern = 75 in. $\times$ 52 in. = 3900 sq. in.

$$277\frac{1}{4} \text{ cu. in.} \times 450 = 124762\frac{1}{2} \text{ cu. in.}$$

Required depth = $124762\frac{1}{2}$ cu. in. $\div 3900$ sq. in. = 31·99 in.

(8)...Transverse diameter of outer ellipse

= 45 yds. + (8 ft. $\times$ 2) = 151 ft.

Conjugate diameter = 28 yds. + (8 ft. $\times$ 2) = 100 ft.

Area of outer ellipse = 151 ft. $\times$ 100 ft. $\times$ ·7854

$$= 15100 \text{ sq. ft.} \times \text{·7854}$$
$$= 11859·54 \text{ sq. ft.}$$

Area of inner ellipse = 135 ft. $\times$ 84 ft. $\times$ ·7854

$$= 11340 \text{ sq. ft.} \times \text{·7854}$$
$$= 8906·436 \text{ sq. ft.}$$

Area of walk = 11859·54 sq. ft. $-$ 8906·436 sq. ft.

$$= 2953·104 \text{ sq. ft.}$$

Gravel required = 2953·104 sq. ft. $\times \frac{1}{4}$ ft.

$$= 738·276 \text{ cu. ft.}$$
$$= 27·3435 \text{ cu. yds.}$$

(9)...    Area of section of column = $(1\frac{1}{2})^2 \times \cdot 7854$

$= 2\frac{1}{4}$ sq. ft. $\times \cdot 7854$

$= 1\cdot 76715$ sq. ft.

Solidity of column = $1\cdot 76715$ sq. ft. $\times 36$ ft.

$= 63\cdot 6174$ cu. ft.

1 cu. ft. of the marble weighs 2700 oz.

$$\underset{1}{\overset{\text{cu. ft.}}{}} : \underset{63\cdot 6174}{\overset{\text{cu. ft.}}{}} :: \underset{2700}{\overset{\text{oz.}}{}} : \underset{171766\cdot 98}{\overset{\text{oz.}}{}}$$

$171766\cdot 98$ oz. = 4 tons 15 cwt. 3 qrs. 11 lb. $6\cdot 98$ oz.


(10)...    Inside measurement, length of box = 20 in.

breadth   „   = 14 in.

depth   „   = 12 in.

Gunpowder, 20 in. $\times$ 14 in. $\times$ 12 in. = 3360 cu. in.

1 cu. ft. of gunpowder weighs 932 oz.

$$\underset{1728}{\overset{\text{cu. in.}}{}} : \underset{3360}{\overset{\text{cu. in.}}{}} :: \underset{932}{\overset{\text{oz.}}{}} : \underset{1812\frac{2}{3}, \text{ gunpowder}}{\overset{\text{oz.}}{}}$$

$$\text{Wood in box} = \overset{\text{in. in. in.}}{(22 \times 16 \times 14)} - \overset{\text{in. in. in.}}{(20 \times 14 \times 12)}$$

$= 4928$ cu. in. $- 3360$ cu. in. $= 1568$ cu. in.

1 cu. ft. of oak weighs 925 oz.

$$\underset{1728}{\overset{\text{cu. in.}}{}} : \underset{1568}{\overset{\text{cu. in.}}{}} :: \underset{925}{\overset{\text{oz.}}{}} : \underset{839\frac{19}{54}, \text{ oak}}{\overset{\text{oz.}}{}}$$

Weight of box = $839\frac{19}{54}$ oz.

Weight of gunpowder = $1812\frac{2}{3}$ oz.

Gross weight = $\overline{2652\frac{31}{54}}$ oz. = 165 lb. $12\frac{31}{54}$ oz.

*EXERCISE XLIX.*

(1)...Perimeter of room $=$ $(22\frac{1}{2}$ ft. $+18$ ft.$) \times 2 = 81$ ft.

Area of walls $= 81$ ft. $\times 11$ ft. $= 891$ sq. ft.

Door ............... $7\frac{1}{2}$ ft. $\times 3\frac{5}{6}$ ft. $= 28\frac{3}{4}$ sq. ft.
2 windows, each... $6$ ft. $\times 3\frac{2}{3}$ ft. $= 44$ „
Fireplace ......... $5$ ft. $\times 5$ ft. $= 25$ „
Skirting-board ...$72\frac{1}{6}$ ft. $\times$ $\frac{1}{2}$ ft. $= 36\frac{1}{12}$ „
$\overline{133\frac{5}{8}}$ sq. ft.

Area to be papered $= 891$ sq. ft. $-133\frac{5}{8}$ sq. ft.
$= 757\frac{1}{8}$ sq. ft.
$= 84$ sq. yds. 1 sq. ft. 24 sq. in.

(2)...Area of garden $= 40$ yds. $\times 40$ yds. $= 1600$ sq. yds.

2 paths, each 120 ft. $\times 4$ ft. $= 960$ sq. ft.
2 paths, each 112 ft. $\times 5$ ft. $= 1120$ „
1 path .........112 ft. $\times 6$ ft. $= 672$ „
1 path .........104 ft. $\times 6$ ft. $= 624$ „
$9)\overline{3376}$
$375$ sq. yds. 1 sq. ft.

1600 sq. yds. $-375$ sq. yds. 1 sq. ft. $= 1224$ sq. yds. 8 sq. ft.

(3)... $ab = \sqrt{2(16)^2} + 1$ ft.
$= \sqrt{512} + 1$ ft.
$= 22{\cdot}6274$ ft. $+1$ ft.
$= 23{\cdot}6274$ ft.
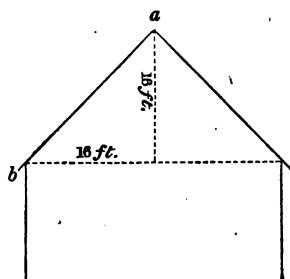


Area of roof $= 23{\cdot}6274$ ft. $\times 44$ ft. $\times 2$
$= 1039{\cdot}6056$ sq. ft. $\times 2$
$= 2079{\cdot}2112$ sq. ft.

(4)... The arc of the semicircle $= \frac{11}{7}$ of the diameter

$$\frac{11}{7} + 1 = \frac{18}{7}$$

$$\frac{18}{7} \;:\; 1 \;::\; \overset{\text{yds.}}{324} \;:\; \overset{\text{yds.}}{126}, \text{ diameter}$$

$$
\begin{aligned}
\text{Area of plantation} &= \tfrac{1}{2}\{\overset{\text{yds.}}{(126)^2 \times \cdot 7854}\}\\
&= \tfrac{1}{2}(15876 \text{ sq. yds.} \times \cdot 7854)\\
&= \tfrac{1}{2}(12469 \cdot 0104 \text{ sq. yds.})\\
&= 6234 \cdot 5052 \text{ sq. yds.}\\
&= 1 \text{ ac. } 1 \text{ ro. } 6 \text{ per. } 3 \text{ sq. yds.}
\end{aligned}
$$

(5)...

$$
\begin{aligned}
\text{Surface of hill} &= \tfrac{1}{2}(150 \text{ yds.} \times 50 \text{ ft.})\\
&= \tfrac{1}{2}(450 \text{ ft.} \times 50 \text{ ft.})\\
&= \tfrac{1}{2}(22500 \text{ sq. ft.})\\
&= 11250 \text{ sq. ft.}\\
&= 1250 \text{ sq. yds.}
\end{aligned}
$$

(6)...The areas of circles are to one another as the squares of their diameters.

$$
\overset{\text{la. da. ho.}}{2 \times 45 \times 10} \;:\; \overset{\text{la. da. ho.}}{3 \times x \times 9} \;::\; \overset{\text{fa.}}{5^2 \times 60} \;:\; \overset{\text{fa.}}{8^2 \times 75}
$$

$$x = \frac{2 \times \cancel{45} \times 10 \times \cancel{64} \times \cancel{75}}{\cancel{3} \times \cancel{9} \times \cancel{25} \times \cancel{60}} = \frac{320}{3} \text{ da.} = 106\tfrac{2}{3} \text{ da.}$$

(7)...

$$
\overset{\text{in.}}{8^2 \times 6\tfrac{3}{4}} \;:\; \overset{\text{in.}}{(4\tfrac{1}{2})^2 \times 8} \;::\; \overset{\text{lb.}}{1} \;:\; \overset{\text{lb.}}{x}
$$

$$x = (20\tfrac{1}{4} \times 8) \div (9 \times 6\tfrac{3}{4})$$

$$= \frac{\cancel{81}}{\cancel{4}} \times \frac{8}{1} \times \frac{1}{\cancel{9}} \times \frac{\cancel{4}}{\cancel{27}} = \frac{8}{3} \text{ lb.} = 2 \text{ lb. } 10\tfrac{2}{3} \text{ oz.}$$

(8)...     1 gallon $= 34\frac{2}{3}$ cu. in. $\times 8 = 277\frac{1}{3}$ cu. in.

6 ft. 3 in. $\times$ 3 ft. 4 in. $\times$ 2 ft. 3 in. $=$ 75 in. $\times$ 40 in. $\times$ 27 in.

$$= 81000 \text{ cu. in.}$$

$$81000 \div 277\frac{1}{3} = 292\frac{7}{104} \text{ gal.}$$

(9)...     Silk in balloon $= \overset{\text{ft.}}{(35)^2} \times 3\cdot1416$

$$= 1225 \text{ sq. ft.} \times 3\cdot1416$$

$$= 3848\cdot46 \text{ sq. ft.}$$

$$= 427\cdot60\dot{6} \text{ sq. yds.}$$

Gas required $= \overset{\text{ft.}}{(35)^3} \times \cdot5236$

$$= 42875 \text{ cu. ft.} \times \cdot5236$$

$$= 22449\cdot35 \text{ cu. ft.}$$

(10)...     $\overset{\text{mi.}}{2^2 \times 1} \quad : \quad \overset{\text{mi.}}{4^2 \times 15} \quad :: \quad \overset{\text{gal.}}{20} \quad : \quad \overset{\text{gal.}}{x}$

$$x = \frac{\cancel{16}^{4} \times 15 \times 20}{\cancel{4}} = 1200 \text{ gal.}$$

## EXERCISE L.

(1)...Area of field $= 125$ yds. $\times 108$ yds. $= 13500$ sq. yds.

Area of each plantation $= \frac{1}{2}(20 \text{ yds.} \times 20 \text{ yds.})$
$$= \frac{1}{2}(400 \text{ sq. yds.})$$
$$= 200 \text{ sq. yds.}$$

13500 sq. yds. $- (200$ sq. yds. $\times 4)$
$$= 13500 \text{ sq. yds.} - 800 \text{ sq. yds.}$$
$$= 12700 \text{ sq. yds.}$$
$$= 2 \text{ ac. } 2 \text{ ro. } 19 \text{ po. } 25\frac{1}{4} \text{ sq. yds.}$$

(2)...                $\frac{11}{20}$ of a mile = 968 yds.

Area of two footways = 968 yds. × 7 yds.

= 6776 sq. yds.

Area of carriage-way = 968 yds. × 11 yds.

= 10648 sq. yds.

|  | £ | s. |
|---|---|---|
| 6776 sq. yds. at 3s. 6d. per yd. = | 1185 | 16 |
| 10648 sq. yds. at 2s. 3d. per yd. = | 1197 | 18 |
|  | £2383 | 14s. |

(3)...

B



2850

3450

4400

A

C

3780

2370

D
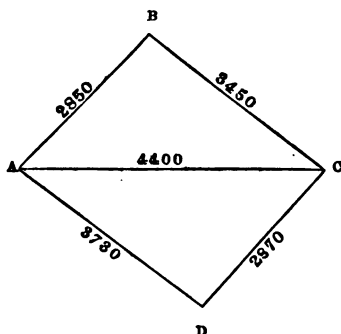
$2\frac{1}{2}$ miles = 4400 yards.

| 2850 | 5350 − 2850 = 2500 |
|---|---|
| 3450 | 5350 − 3450 = 1900 |
| 4400 | 5350 − 4400 = 950 |
| 2)10700 | |
| 5350 | |

5350 × 2500 × 1900 × 950 = 24141875000000

Area of triangle ABC = $\sqrt{24141875000000}$

= 4913438·2 sq. yds.

$$3730$$
$$2870$$
$$4400$$
$$2\overline{)11000}$$
$$5500$$

$$5500-3730 = 1770$$
$$5500-2870 = 2630$$
$$5500-4400 = 1100$$

$$5500 \times 1700 \times 2630 \times 1100 = 28163355000000$$

Area of triangle ADC $= \sqrt{28163355000000}$
$= 5306915\cdot7$ sq. yds.

$$4913438\cdot2$$
$$5306915\cdot7$$

Area of park $= \overline{10220353\cdot9}$ sq. yds.

$= 2111$ ac. 2 ro. 22 po. 28 sq. yds.

(4)...      Transverse diameter of outer ellipse
$= 16$ ft. $+ (2\text{ft.} \times 2) + (3\frac{1}{2}$ ft. $\times 2) = 27$ ft.
Ditto of middle ellipse $= 16$ ft. $+ (2$ ft. $\times 2) = 20$ ft.
Conjugate diameter of outer ellipse
$= 9$ ft. $+ (2$ ft. $\times 2) + (3\frac{1}{2}$ ft. $\times 2) = 20$ ft.
Ditto of middle ellipse $= 9$ ft. $+ (2$ ft. $\times 2) = 13$ ft.

Area of outer ellipse $= 27$ ft. $\times 20$ ft. $\times \cdot7854$
$= 540$ sq. ft. $\times \cdot7854$
$= 424\cdot116$ sq. ft.

Area of middle ellipse $= 20$ ft. $\times 13$ ft. $\times \cdot7854$
$= 260$ sq. ft. $\times \cdot7854$
$= 204\cdot204$ sq. ft.

Area of flower-bed $= 16$ ft. $\times 9$ ft. $\times \cdot7854$
$= 144$ sq. ft. $\times \cdot7854$
$= 113\cdot0976$ sq. ft.

Area of grass border $= 204\cdot204$ sq. ft. $- 113\cdot0976$ sq. ft.
$= 91\cdot1064$ sq. ft.

Area of gravel walk $= 424\cdot116$ sq. ft. $- 204\cdot204$ sq. ft.
$= 219\cdot912$ sq. ft.
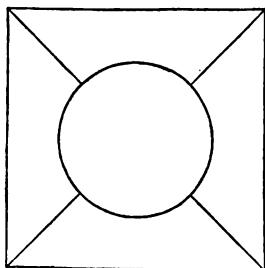
(5)...   5 acres = 24200 sq. yds.

Diagonal of square = $\sqrt{24200 \times 2}$

$= \sqrt{48400}$

= 220 yds.

1 ac. 1 ro. 20 per. = 6655 sq. yds.

Diameter of circle = $\sqrt{6655 \div \cdot 7854}$

$= \sqrt{8473 \cdot 38935574}$

= 92·051 yds.

Length of each path = $\frac{1}{2}$(220 yds. − 92·051 yds.)

$= \frac{1}{2}$(127·949 yds.)

= 63·9745 yds.

(6)...   Circumference of circle = $(15\frac{3}{4}$ ft. $\times 2) \times 3\frac{1}{7}$

$= 31\frac{1}{2}$ ft. $\times 3\frac{1}{7}$

= 99 ft. = 33 yds.

Distance walked in 5 minutes = 33 yds. $\times 21$

= 693 yds.

Distance walked in 1 hour = 8316 yds

8316 yds. = 4 miles, 5 furlongs, 32 poles

(7)...   Contents of mahogany top = $8\frac{1}{2}$ ft. $\times 4\frac{1}{6}$ ft. $\times \frac{5}{48}$ ft.

$= 3\frac{397}{576}$ cu. ft.

| cu. ft. | | cu. ft. | | lb. | | lb. |
|---|---|---|---|---|---|---|
| 34 | : | $3\frac{397}{576}$ | :: | 2240 | : | $243\frac{1}{18}$ |

Contents of oak top = 9 ft. $\times 3\frac{2}{3}$ ft. $\times \frac{1}{8}$ ft. = $4\frac{1}{8}$ cu. ft.

$$\begin{array}{ccccccc} \text{cu. ft.} & & \text{cu. ft.} & & \text{lb.} & & \text{lb.} \\ 39 & : & 4\frac{1}{8} & :: & 2240 & : & 236\frac{12}{13} \end{array}$$

lb.

Weight of mahogany top $243\frac{1}{18}$

Ditto of oak top............ $236\frac{12}{13}$

The mahogany top weighs $\overline{\quad 6\frac{31}{234}\quad}$ lb. heavier than the oak top

(8)... Quantity of clay $= 20$ ft. $\times 9$ ft. $\times 6$ ft. $= 1080$ cu. ft.

Ditto, when compressed $= 1080 - \frac{1}{9}(1080) = 960$ cu. ft.

$$= 1658880 \text{ cu. in.}$$

Area of interior ellipse $= 6$ in. $\times 4$ in. $\times \cdot 7854$

$$= 24 \text{ sq. in.} \times \cdot 7854$$

Area of exterior ellipse $= 8$ in. $\times 6$ in. $\times \cdot 7854$

$$= 48 \text{ sq. in.} \times \cdot 7854$$

Area of oval ring $= (48 - 24) \times \cdot 7854$

$$= 24 \text{ sq. in.} \times \cdot 7854$$

$$= 18 \cdot 8496 \text{ sq. in.}$$

Length of pipe $= 1658880$ cu. in. $\div 18 \cdot 8496$ sq. in.

$$= 88006 \cdot 1115 \text{ in.}$$

$$= 2444 \cdot 6142 \text{ yds.}$$

(9)...
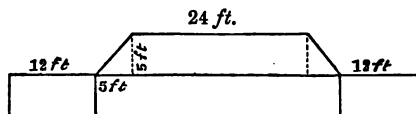


SECTION OF EMBANKMENT AND TRENCHES.

Mean width of embankment $= \frac{1}{2}(24 + 34) = 29$ ft.

Area of section of embankment $= 29$ ft. $\times 5$ ft. $= 145$ sq. ft.

Required depth of trenches $= 145$ sq. ft. $\div (12$ ft. $\times 2)$

$$= 145 \text{ sq. ft.} \div 24 \text{ ft.}$$

$$= 6\frac{1}{24} \text{ ft.}$$

ft.
(10)...    Quantity of silk in balloon $= (35)^2 \times 3{\cdot}1416$

$= 1225$ sq. ft. $\times 3{\cdot}1416$

$= 3848{\cdot}46$ sq. ft.

$= 427{\cdot}60\dot{6}$ sq. yds.

Weight of silk $= 2\frac{3}{4}$ oz. $\times 427{\cdot}60\dot{6} = 1175{\cdot}918\dot{3}$ oz.

ft.
Quantity of gas $= (35)^3 \times {\cdot}5236$

$= 42875$ cu. ft. $\times {\cdot}5236$

$= 22449{\cdot}35$ cu. ft.

Weight of atmospheric air displaced by balloon

$= 1\frac{1}{4}$ oz. $\times 22449{\cdot}35$

$= 28061{\cdot}6875$ oz.

Hence, the weight of the gas in the balloon

$= 28061{\cdot}6875$ oz. $\times {\cdot}069 = 1936{\cdot}2564375$ oz.

oz.
Weight of silk $= 1175{\cdot}918\dot{3}$
Weight of gas $= 1936{\cdot}2564$
Weight of balloon when filled $= \overline{3112{\cdot}1747}$ oz.

oz.
Weight of equal bulk of air $= 28061{\cdot}6875$
$3112{\cdot}1747$
Weight required to balance balloon $= \overline{24949{\cdot}5128}$ oz.

$24949{\cdot}5$ oz. $= 13$ cwt. 3 qrs. 19 lb. $5\frac{1}{2}$ oz.

# OPINIONS

OF

## *THE PRESS AND THE PROFESSION.*

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'Contains 2,000 original Examples, arranged in sets of exercises, graduated as to difficulty. This book is admirably adapted for examination purposes. The Examples, besides being numerous, are varied and good—so good, that we are afraid Mr. Harris will, in regard to this, as in his "Questions in Arithmetic," think himself entitled to complain of various Examination Papers being stocked with his Examples. His books could not have a better recommendation.'— *The Museum and English Journal of Education.*

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